Environmental Impact Statement

NYNGAN SOLAR PLANT

MARCH 2013

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SLR Consulting undertook a peer review of the noise assessment in December 2012, providing correction factors to apply to conservative modelling and endorsement of the report's conclusions.

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Cover: Top left and bottom: photos of the site, taken by AGL, Top right: promotional image, courtesy of First Solar, Inc.

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Certification

I certify that I have prepared the contents of this Environmental Impact Statement in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulations 2000.* To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the project and that information is neither false nor misleading.

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TABLES

FIGURES

TERMS AND DEFINITIONS

AADT	Annual Average Daily Traffic
A-weighting	An adjustment made to the sound level measurement to approximate the response of the human ear
AC	Alternating current
ACHA	Aboriginal Cultural Heritage Assessment
AEMO	Australian Energy Market Operator
AGL	AGL Energy Limited
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
Applicant	Entity applying for development consent under the EP&A Act (refer also proponent)
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AWS	Automatic weather station
BOM	Australian Bureau of Meteorology
BP	Before present
BRMP	Bush Fire Risk Management Plan
BSC or Council	Bogan Shire Council
CdTe	Cadmium Telluride
CEI	(Australian Government's) Clean Energy Initiative
CEMP	Construction environmental management plan
CMA	Catchment Management Authority
CWD	Coarse woody debris
Cwth	Commonwealth
dB	Decibel
dB(A)	A measure of A-weighted *(c.f.)* sound levels.
DC	Direct current
DECCW	Refer to OEH
DEMP	Decommissioning environmental management plan
DGRs	Director General's Requirements
DoPI	(NSW) Department of Planning and Infrastructure
DPI	(NSW) Department of Primary Industries
DSEWPC	(Cwth) Department of Sustainability, Environment, Water, Population and Communities
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EIA	Environmental impact assessment
EIS	Environmental impact statement
ELA	(Mineral) Exploration Licence Application

ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electromagnetic fields
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EPA	(NSW) Environment Protection Authority
EPL	Environment Protection Licence, issued under the POEO Act *(c.f.)*
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
ESD	Ecologically Sustainable Development
GHG	Greenhouse gas
GWh	Gigawatt hours
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
Hz	Hertz
IPCC	Intergovernmental Panel on Climate Change
ILUA	Indigenous land use agreement
kL	kilolitre
km	kilometre
L_{A90} (15 minutes)	The A-weighted sound pressure level that is exceeded for 90% of a 15-minute measurement period, when measured in the absence of the construction works under consideration and excluding extraneous noise. This is considered to represent the background noise.
L_{Aeq}(15 minutes)	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 15-minute period that excludes other noise sources such as from industry, road, rail and the community.
LALC	Local Aboriginal Land Council
LCA	Life Cycle Analysis, an assessment and quantification of the energy and material flows associated with a given process or product to identify the resource impacts of that process.
LEP	Local Environment Plan
LGA	Local Government Area
m	metres
NEFR	National Electricity Forecasting Report
NEM	National Electricity Market
NWBFMC	North West Bush Fire Management Committee
OEMP	Operational environmental management plan
mG	Milligauss, multiples of a unit of magnetic field Gauss unit
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRET	Mandatory Renewable Energy Target
MW	Megawatt
MWh	Megawatt hours

NNTT	National Native Title Tribunal
NW Act	*Noxious Weeds Act 1993* (NSW)
NSW	New South Wales
LCU	Landscape character units – areas similar in terms of landform, vegetation patterns, water form and land use patterns
LRET	Large-scale Renewable Energy Target
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PAC	(NSW) Planning Assessment Commission
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Proponent	The person or entity proposing a development, in this instance, AGL.
PV	Photovoltaic
RBL	Rating Background Level - the level of background noise
RE Act	*Renewable Energy (Electricity) Act 2000* (Cwth)
REC	Renewable Energy Certificate
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
RMS	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
Roads Act	*Roads Act 1993* (NSW)
SEPP	State Environmental Planning Policy (NSW)
SEPP (Infrastructure)	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
Sound pressure level	The noise at a given distance from plant or equipment
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SIS	Species Impact Statement
sp/spp	Species/multiple species
SRES	Small-scale Renewable Energy Scheme
SSD	State Significant Development, as defined by section 89C of the EP&A Act *(c.f.)*
The proposal	The Nyngan Solar Plant project, including the construction, operation and decommissioning of the Nyngan Solar Plant, as further described in section 3 of this document.
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
µT	Microtesla , multiples of a unit of magnetic field
V	Volts
VIA	Visual Impact Assessment
WHO	World Health Organisation
WMP	Waste Management Plan

EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Nyngan Solar Plant. **ngh**environmental have prepared the EIS on behalf of the proponent, AGL Energy Limited (AGL).

The EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulations). The structure and content of the EIS address the Director-General's Requirements, provided by NSW Department of Planning and Infrastructure (DoPI) on 24 July 2012.

PROPOSAL DESCRIPTION

The proposal site is located in Central West NSW, approximately 10 kilometres west of the Nyngan township. The site comprises approximately 460 hectares of privately owned agricultural land. The site is largely cleared with some small remnant patches of degraded native vegetation and scattered trees. It is currently used for agriculture (cropping and grazing). A farm dam and water tank are present at the site. No significant infrastructure is currently located at the site.

Infrastructure components proposed at the site include:

- Arrays of photovoltaic (PV) modules utilising cadmium telluride (CdTe) thin film technology.
- Inverters, transformers and underground electrical conduits and cabling within the arrays.
- A substation.
- An operations and maintenance building.
- Internal tracks.
- An approximate 3 kilometre transmission line.
- An approximate 1.6 kilometre access road off the Barrier Highway.

The solar plant would be located on one land parcel covering approximately 300 hectares. The transmission line easement would cover approximately 14 hectares.

NEED FOR THE PROJECT

Electricity in NSW is generated from a wide range of fuel sources, including black coal, natural gas, coal seam methane gas and to a lesser extent from renewable energy sources such as hydro, wind, biomass and solar (NSW T&I 2012).

According to DCCEE (2012b), energy generation is the largest individual contributor of greenhouse gas (GHG) emissions in Australia. As GHG emissions have been identified as a major contributor to climate change (IPCC 2008) and production of renewable energy produces low or, as is the case of solar PV, zero GHG emissions (U.S. DoE 2004), there is an important role for the development of renewable energy generation projects in combating climate change.

It is noted that while current projections by AEMO indicate that NSW will not experience a shortfall of electricity prior to 2021/22, generation from renewable energy sources is essential to meet State and Australian Government renewable energy targets.

KEY ENVIRONMENTAL ASSESSMENT ISSUES

A risk assessment was carried out to identify key environmental risks of the proposal, to guide the depth of investigation in this EIS. The risk assessment identified five environmental aspects as key risks, and detailed investigations were subsequently undertaken in these areas as part of this EIS:

- Biodiversity impacts and offsetting requirements
- Aboriginal heritage
- Hydrology, including flooding
- Noise
- Visual amenity

These issues are investigated in detail in section 6 of this EIS. Lower risk issues are investigated in section 7, primarily by desktop assessment.

Summary of results

Regarding biodiversity impacts, constraints mapping was undertaken in order to guide the infrastructure layout to avoid impacts, where possible, in higher conservation value areas. Impacts to threatened entities (i.e., species, populations and ecological communities) can be managed to avoid a significant impact. This includes retaining the north-south corridor of native trees in the centre of the site by altering the layout to avoid these trees. Management measures have been developed to minimise risks to biodiversity, including weed control, site traffic control, groundcover management and site rehabilitation. Clearing of native vegetation would be offset in perpetuity and provision would be made in the offsets for the protection of Grey-Crowned Babbler habitat.

Regarding Aboriginal heritage, field investigations and a predictive model found the site to be of low scientific significance (as it is highly disturbed from cultivation) and further investigation is not considered to be necessary. In respect of Aboriginal community consultation, no comments were received during the 28 day period for review of the draft Aboriginal Cultural Heritage Assessment (ACHA) report.

The site and surrounds are flat and a hydrology study was used in order to guide placement of infrastructure to minimise flooding risks. The study confirmed the solar plant site is not subject to flooding from Whitbarrow Creek above a depth of 0.3 metres in a 100 year ARI event and infrastructure has been sited in response to the study's recommendations. Groundwater (locally, at a depth of 30-60m) would not be impacted by the proposal.

Regarding noise and visual amenity, there are few receivers within close proximity to the proposal site. For construction of the solar plant, modelled construction noise levels at the closest receiver (a property involved with the project) were found to comply with noise criteria by 4 dBA. For the other properties located further from the site, to the west and south, the margin of compliance ranges from 8 to 14 dBA. For construction of the transmission line and main access road, predicted noise levels were found to comply by 3 dBA at the nearest receiver. For the other three dwellings, the level of compliance is 8 dBA. It should be noted that these predictions allow for a worst case scenario and it is anticipated that during typical construction works the level of noise at any receiver will actually be less than that reported, with a larger margin of compliance. Operational noise associated with the project was assessed to be minor.

The visual impact significance at 16 specific locations was assessed as low. Photomontages depicting the view of the solar plant from nearby viewpoints demonstrate that views of the plant would be limited. The cumulative visual impact resulting from adding the solar plant would be minor to insignificant.

Community consultation demonstrated there is little concern in the local community about the visual impacts of the proposed development; most respondents were in favour of the proposal. Glare due to light reflection from the solar panels is expected to be negligible given the distance of the solar plant from the Barrier Highway, the presence of intervening trees, and the orientation of the PV modules away from the Highway. Sixteen view points were assessed separately in a specialist visual assessment, and all were considered to have low impact significance.

Other impacts considered included:

- Air quality.
- Health and safety.
- Land use, including impacts on mineral resources.
- Socioeconomic and community. There is support for the proposal in the local community and local economic benefits were identified.
- Traffic, transport and road safety.
- Resource use and waste generation.
- Fire and bush fire issues.
- Historic heritage.
- Soil and water, including water use.
- Cumulative impacts.

MANAGEMENT OF IMPACTS

A preliminary constraints analysis was used to inform the location of infrastructure in the early planning phase, to avoid environmental impacts where possible. Impacts of the proposed solar plant relate primarily to the construction of the project. Primary impacts include clearing of vegetation for the solar plant and associated infrastructure, construction noise, construction traffic and dust. The main impacts associated with operation relate to visual impact and temporary reduction in agricultural production at the site. Decommissioning impacts are generally of a similar nature but to a lesser extent than construction impacts. Mitigation measures and safeguards have been developed and incorporated into the proposal to minimise and offset its residual impacts.

The management measures include prescriptions to further reduce impacts where possible (such as for biodiversity and visual impacts, which largely relate to infrastructure placement and design) as well as standard protocols to manage activities that carry a pollution risk (such as management of fuels and excavation activities). They are precautionary in that where uncertainty was present regarding risk, a mitigation measure has been included. There is a high degree of certainty regarding the ability of the measures to manage the risks identified. Further, the proposal is viewed as largely reversible; at the end of the project all above ground infrastructure would be removed and current agricultural land use activities could resume or other potential land uses, such as residential development or mining, could be considered.

With the implementation of these measures, this EIS demonstrates that:

Potential impacts are manageable and would not result in a significant impact to the environment, including any Matters of National Environmental Significance.

CONCLUSION

The proposal would comply with the Acts and Regulations relevant to the site and the type of development proposed. It is compatible with surrounding land uses and would not diminish future options for land use or resources use. It provides several broad benefits:

- Reduction in greenhouse gas emissions and a move towards cleaner electricity generation.
- Supply of renewable energy which would assist the Commonwealth Government to reach the Renewable Energy Target of 20 per cent by 2020, and the NSW Government to achieve the objectives set out in the draft NSW Renewable Energy Action Plan.
- Provision of additional electricity generation and supply into the Australian grid.
- Social and economic benefits through the provision of direct and indirect employment opportunities, during both construction and operation of the solar plant.

The proposal is considered to be consistent with the principles of Ecologically Sustainable Development. Specifically, the proposal would address the need to minimise the risk of climate change to current and future generations by reducing carbon emissions.

In light of the benefits of the proposal, the low level of environmental impact anticipated and the high level of manageability related to these impacts, the proposal is considered to be ecologically sustainable and justified.

1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Nyngan Solar Plant. **ngh**environmental have prepared the EIS on behalf of the proponent, AGL Energy Limited (AGL).

This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulations). The structure and content of the EIS address the Director-General's Requirements, provided by NSW Department of Planning and Infrastructure (DoPI) on 24 July 2012.

1.2 PROPOSAL OVERVIEW

1.2.1 Proposed location of the Nyngan Solar Plant

The proposal site is located 10 kilometres west of Nyngan, NSW, within the Cobar Peneplain Bioregion. Nyngan is approximately 460 kilometres northwest of Sydney. It is within the area administered by the Central West Catchment Management Authority (CMA) and in the Bogan Shire Local Government Area (LGA). The site comprises rural land utilised for grazing and cropping, and is largely cleared with some small remnant patches of degraded native vegetation and scattered trees.

1.2.2 Proposed construction and operation of the Nyngan Solar Plant

The Nyngan Solar Plant would have a nominal capacity of up to approximately 106 megawatts (MW). The construction phase would take approximately 18 months. In addition to construction of the solar plant and substation, a transmission line and easement would be constructed over a length of approximately 3 kilometres to connect the solar plant with the existing Nyngan – Cobar 132 kilovolt (kV) transmission line. Road and intersection upgrades would be undertaken as necessary to facilitate construction.

The solar plant is expected to have a 30 year operating life. Approximately 2-3 operations and maintenance personnel would operate the plant.

Decommissioning would remove all above ground infrastructure, rehabilitating the site to allow for a return to agricultural or other land use.

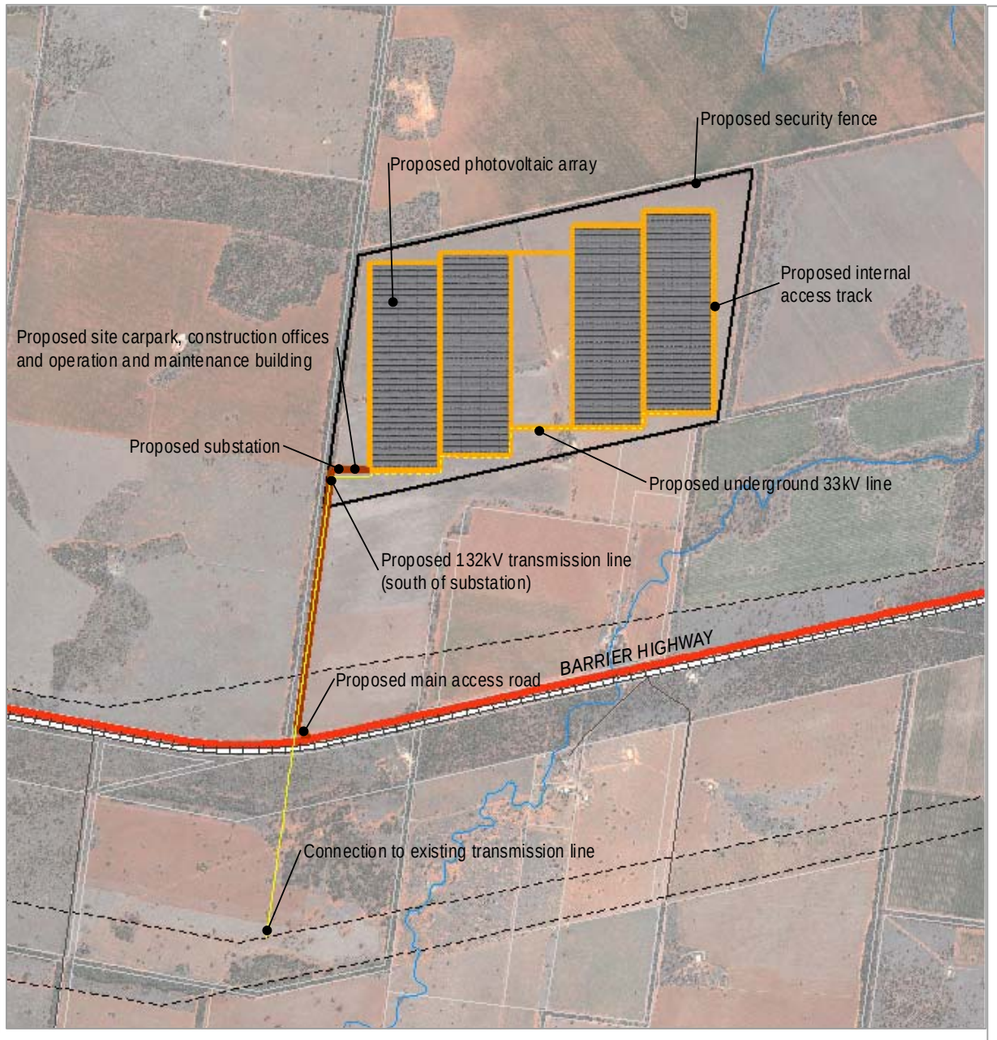
The proposal site, surrounding area and proposed layout (subject to detailed design) is shown in Figure 1-1. Land zoning at and surrounding the proposal site is shown in Figure 1-2. An indicative site plan is provided in Appendix E.

SITE LOCATION RELATIVE TO NYNGAN

0 5 10 20 Kilometres

Notes:
- Infrastructure locations are approximate only
- Other base layers from LPI, accessed 2012
- Aerial base layer from Bing (ESRI Online) accessed 2012

SITE LAYOUT



0 0.5 1 2 Kilometres

Notes:
- Infrastructure locations are approximate only
- Other base layers from LPI, accessed 2012
- Aerial base layer from Microsoft Virtual Earth accessed 2012

Proposed transmission line
- 132 kV
- Underground 33 kV

Proposed roads and tracks
- Internal access track
- Main access road
- Development site (fenced)
- Rail
- Highway
- Built up area (Nyngan)
- Road
- Existing transmission line

Ref: 4554v1.4 VIA
Author: SP

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Figure 1-1 Location and layout of proposed development.

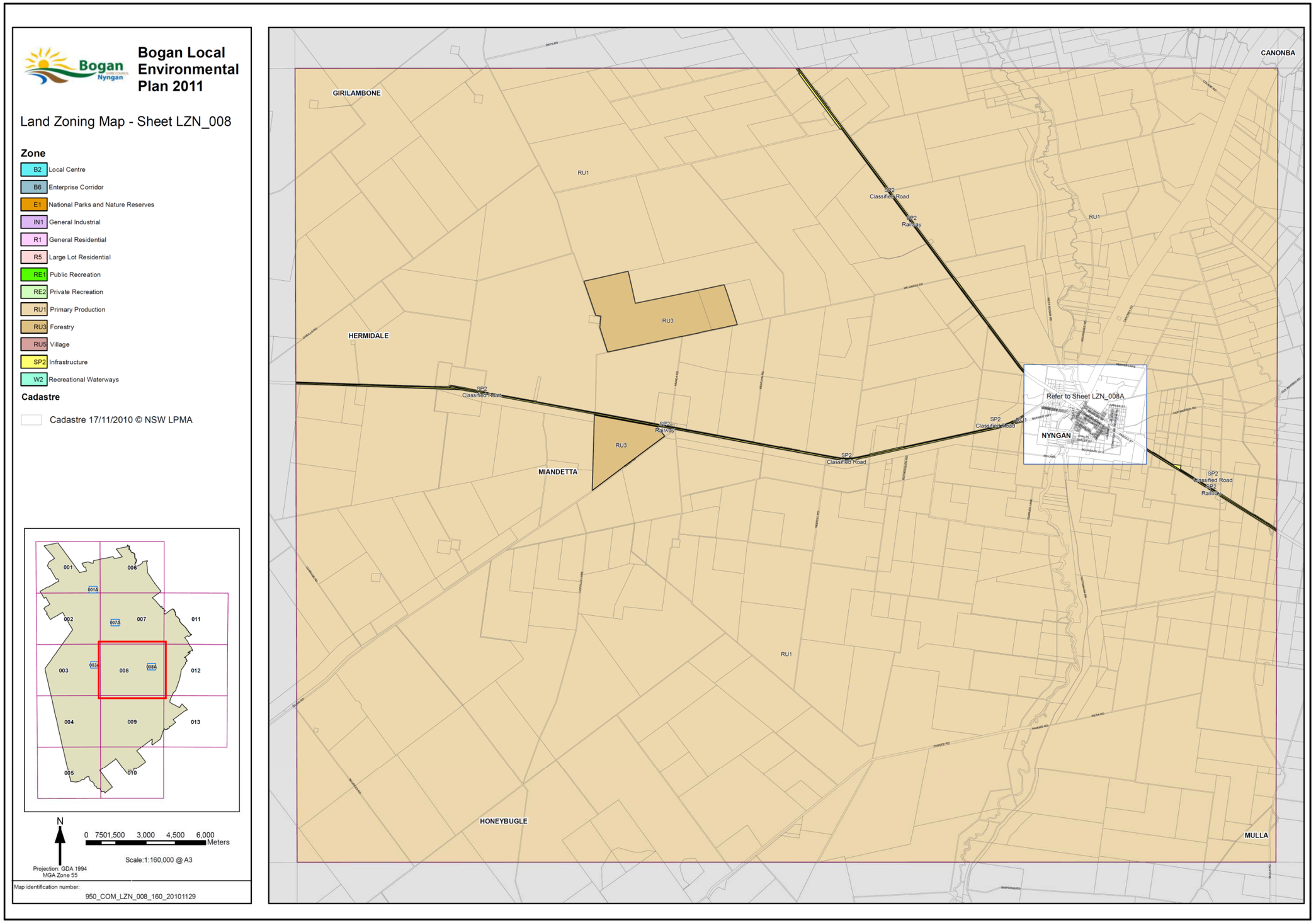


Figure 1-2 Land zoning map.

1.3 BACKGROUND TO THE PROPOSAL

1.3.1 The Proponent

The proponent is AGL Energy Limited (AGL).

AGL is the largest private owner, operator and developer of renewable generation in Australia and has invested over $2 billion in renewable energy. AGL has major investments in hydro and wind power, as well as ongoing developments in key renewable areas including solar, geothermal, biomass, bagasse and landfill gas. AGL also operates retail, merchant energy and upstream gas businesses and has over three million customer accounts.

1.3.2 Solar Flagships Program

The primary objective of the Solar Flagships Program is to provide the foundation for large scale, grid-connected, solar power to play a significant role in Australia's electricity supply and to operate within a competitive electricity market.

Other objectives of the Solar Flagships program, and hence the Nyngan Solar Plant project, are to:

- Develop a solar industry in Australia.
- Encourage regional development.
- Provide research infrastructure.
- Develop Australian intellectual property in solar power generation.
- Develop and share technical and economic knowledge from the Solar Flagships program.

AGL has been selected by the Australian Government as the successful applicant in the solar photovoltaic (PV) category of the Solar Flagships Program independent reassessment process. The Nyngan Solar Plant is one of two solar power stations proposed by AGL under the Solar Flagships Program. The second is proposed to be constructed at Broken Hill in Far West NSW. The Australian Government and NSW Government have committed funding to support the implementation of both projects.

2 NEED AND JUSTIFICATION OF THE PROJECT

2.1 ENERGY CONTEXT IN AUSTRALIA AND NSW

2.1.1 Electricity generation in NSW

Electricity in NSW is generated from a wide range of fuel sources, including black coal, natural gas, coal seam methane gas and to a lesser extent from renewable energy sources such as hydro, wind, biomass and solar (NSW T&I 2012).

NSW has around 18,000 MW of installed electricity generation capacity. Interconnectors with Queensland and Victoria provide additional capacity of about 1,100 MW and 1,500 MW respectively. Over 20,000 MW of power plant proposals (including over 9,000 MW from renewable sources) are at various stages of development from concept to construction.

Table 2-1 Existing major power station capacity by technology in NSW.

Technology	Capacity (MW)
BaGasse	60
Combined Cycle Gas Turbine	435
Coal Tailings	145
Coal Seam Methane	97
Gas Cogen	160
Hydro	4,046
Open Cycle Gas Turbine	1,316
Steam/Coal	11,040
Wind	266
Total	**17,565**

Note: Table only includes major power stations with capacities over 30 MW.

Source: NSW T&I 2012

2.1.2 National Electricity Market

Energy is one of Australia's largest industries and Australia is the world's ninth largest energy producer. The National Electricity Market (NEM), Australia's wholesale electricity market for the supply of electricity to retailers and end-users, has operations in five interconnected regions – Queensland, New South Wales and the Australian Capital Territory, Victoria, South Australia and Tasmania (AEMO 2010). The independent Australian Energy Market Operator (AEMO) manages operation of the NEM. AEMO recently published the first version of the 2012 National Electricity Forecasting Report (NEFR).

The NEFR presents the electricity demand forecast for the five NEM regions. AEMO (2012) forecast an average growth in energy (GWh) for the 10-year period 2012-13 to 2021-22 to be 1.7 per cent across the NEM. This growth is expected to be strongly linked to large industrial projects in Queensland (AEMO 2012). Table 2-2 illustrates recent actual energy and medium, high and low economic growth scenario

energy projections for NSW (including the ACT) in gigawatt hours (GWh). NSW (inclusive of the ACT) is forecast to have the third highest annual energy growth rate (1.2%) under the medium scenario of the five NEM regions, behind Queensland (2.9%) and Victoria (1.4%) respectively.

Table 2-2 Annual energy forecasts for New South Wales (including the ACT) (GWh).

Year	Actual	High (Scenario 2, Fast World Recovery	Medium (Scenario 3, Planning)	Low (Scenario 6, Slow Growth
2006-07	75,436	-	-	-
2007-08	75,878	-	-	-
2008-09	75,488	-	-	-
2009-10	74,772	-	-	-
2010-11	74,512	-	-	-
2011-12 (estimate)	71,468	-	-	-
2012-12	-	70,354	70,007	69,551
2013-14	-	71,507	70,887	70,015
2014-15	-	73,006	72,133	70,341
2015-16	-	74,503	73,128	70,750
2016-17	-	75,757	73,912	70,929
2017-18	-	77,268	75,106	71,540
2018-19	-	77,886	75,518	71,282
2019-20	-	78,805	76,181	71,322
2020-21	-	79,902	76,948	71,578
2021-22	-	80,894	77,669	71,633
Average annual growth	-	1.56%	1.16%	0.33%

Source: AEMO 2012

The following extract from SKM (2012) describes predicted energy demand and transmission constraints in NSW at this time.

> *Current projections by AEMO indicate that NSW will not experience a shortfall of electricity prior to 2021/22 (AEMO, 2012a). There has been significant interest in generation as indicated by investment across the various sectors of electricity generation sources. A total of 13,192 MW has been publicly announced of which solar represents 600 MW (AEMO, 2012a)...*
>
> *... Congestion and network constraints also exist in certain areas of the NSW transmission network. Typically, the loading on transmission networks is highest during summer and winter. The main network constraints relate to thermal overload and line rating and voltage control issues (TransGrid, 2010). The number of locations where new generation could be connected to the NSW transmission network without the need to augment the network is now limited. It is essential that the transmission network is developed so that it has adequate capability to transfer power under a range of future generation development scenarios (TransGrid, 2010).*

It is noted that while current projections by AEMO indicate that NSW will not experience a shortfall of electricity prior to 2021/22, generation from renewable energy sources is essential to meet State and Australian Government renewable energy targets (discussed below in section 2.2).

2.2 STRATEGIC DIRECTION OF THE REGION AND STATE

Australia is a signatory to various international agreements, conventions and protocols. Some, including the United Nations Framework Convention on Climate Change and the Kyoto Protocol, involve commitments requiring action relating to climate change and greenhouse gas emissions.

The Australian and NSW Governments have each developed strategies and set targets in relation to renewable energy generation that will assist in meeting energy demand while at the same time reducing greenhouse gas emissions. Key plans, strategies and targets, and how the proposal relates to them, are discussed below.

2.2.1 Australia's Renewable Energy Target

In 2001, the Commonwealth Government introduced the Mandatory Renewable Energy Target (MRET) Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The MRET requires liable entities (energy retailers and large energy users) to purchase a proportion of their energy requirements from renewable energy sources through the acquisition of renewable energy certificates (REC) (ESAA 2012).

In 2009, the MRET was expanded from a target of 9,500 GWh of Australia's electricity supply produced from renewable energy sources in 2010, to the current target of 20 per cent of Australia's electricity supply by 2020, or 45,000 GWh. Due to the large increase in the target, the expanded national RET scheme is expected to accelerate the development and deployment of a broad range of renewable energy technologies including solar, biomass and geothermal energy (DCCEE 2012c).

From January 2011, the existing target was divided into two components, separating large and small-scale projects, which combined are expected to exceed the 45,000 GWh target (refer Table 2-3). At this time, RECs were also reclassified as either large-scale generation certificates (LGCs) and small-scale technology certificates (STCs).

Table 2-3 Renewable Energy Target Scheme components.

RET Scheme component	Examples of energy projects supported	Target
Large-scale Renewable Energy Target (LRET)	Wind farms, **utility-scale solar plants**, hydro-electric power stations, geothermal.	41,000 GWh
Small-scale Renewable Energy Scheme (SRES)	Solar photovoltaic systems, solar water heaters and heat pump systems, small-scale wind systems, small-scale hydro systems.	Uncapped, however 11,000 GWh estimated by 2020 (ESAA 2012)

LRET includes legislated annual targets, which progressively increase until 2020 at which time the full 41,000 GWh target is set. Annual LRET targets are set out below.

Table 2-4 Annual LRET Targets 2012-2030.

Year	LRET target (GWh)
2012	12,300
2013	14,200
2014	16,100
2015	18,000
2016	22,600
2017	27,200
2018	31,800
2019	36,400
2020	41,000
2021-2030	41,000

Source: DCCEE 2012d

The Nyngan Solar Plant would produce an estimated 231,000 MWh per year of renewable electricity that would assist in meeting the LRET. This would constitute approximately 1.3 per cent of the annual LRET target for 2015, the year it is proposed to become operational, and approximately 0.6 per cent of the overall LRET target.

2.2.2 Solar Flagships Program

To assist in achieving the 20 per cent target and emphasise the need to invest in clean energy technologies, the Australian Government has committed funding of $1.5 billion to the Solar Flagships Program, which is part of the Clean Energy Initiative (CEI). The Solar Flagships Program has been designed to accelerate the delivery of large scale, grid-connected solar power into the National Electricity Market, and shows the Government's commitment to large scale solar projects and cleaner, greener electricity generation.

The Australian Government has selected AGL as the successful applicant in the solar PV category of the Solar Flagships Program independent reassessment process. AGL, together with First Solar, would deliver two large-scale solar plants projects at Nyngan and Broken Hill, NSW, with nominal capacities of up to approximately 106 MW and up to approximately 53 MW, respectively.

2.2.3 NSW 2021: A Plan to Make NSW Number One

This plan was released in 2011, replacing the State Plan as the NSW Government's strategic business plan, setting priorities for action and guiding resource allocation. Goal 22 of this plan seeks to protect our natural environment, and includes a specific target to increase renewable energy. A commitment is made to:

> *contribute to the national renewable energy target [i.e. 20% renewable energy supply] by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources.*

Specific initiatives under this target directly support building solar power plant/s under the Solar Flagships Program in partnership with the Commonwealth Government. Additionally, a strategic move towards renewable energy generation is supported through the establishment of a Joint Industry Government Taskforce to develop a Renewable Energy Action Plan for NSW which would identify opportunities for investment in renewable energy sources (refer 2.2.4).

2.2.4 DRAFT NSW Renewable Energy Action Plan

The NSW Government sees renewable energy as a key part of their vision for a secure, affordable and clean energy future for NSW (NSW Government 2012a). A NSW Renewable Energy Action Plan is being developed to support the achievement of the national target of 20% renewable energy by 2020. Action 8 of the *DRAFT NSW Renewable Energy Action Plan* (NSW Government 2012b) directly supports the development of AGL's large-scale solar PV plant at Nyngan:

> *Engage with the Commonwealth Government to facilitate construction of the Solar Flagships project in Broken Hill and Nyngan, with $64.85 million in funding from the NSW Government.*

The *DRAFT NSW Renewable Energy Action Plan* is currently on public exhibition, with comments invited until 26 October 2012.

2.3 CLIMATE CHANGE AND RENEWABLE ENERGY

There is scientific evidence that the Earth's climate is changing. Some impacts of this are already being observed (increases in air and ocean temperatures, widespread melting of snow and ice and rising sea levels) with other indicators including altered rainfall patterns and more frequent or intense weather patterns such as heatwaves, drought, and storms (DCCEE 2010a). Climate change impacts in Australia are anticipated to affect water supply and quality, ecosystems and conservation, agriculture and forestry, fisheries, settlements and industry and human health, while trade and commodity prices may also be impacted by the global impacts of climate change (DCCEE 2010a).

Both natural and anthropogenic forces have been identified as the drivers for climate change, however a main contributor is the release of greenhouse gases (GHG), particularly carbon dioxide (CO_2), into the atmosphere (IPCC 2008). GHG emissions stay in the atmosphere for decades. A predicted warming of around 0.2°C per decade is already expected regardless of future emission levels, however, if GHG emissions continue to be emitted at their current rate then further and more extreme changes to the global climate system will be experienced (IPCC 2008). Therefore, a reduction in GHG emissions is likely to be able to reduce the rate and magnitude of climate change. Large increases in CO_2 emissions from human-based activities occurred between 1970 and 2004, mostly attributed to the burning of fossil fuels, such as coal, for energy generation. Therefore the IPCC (2008) recommends a vital step to reducing CO_2 emissions is by employing renewable energy technologies, which have zero (such as PV solar) or low CO_2 emissions.

2.3.1 Greenhouse gas emission benefits – electricity generation

According to DCCEE (2012b), energy generation is the largest individual contributor of GHG emissions in Australia, contributing 201.5 million tonnes (Mt) of CO_2 equivalent emissions in 2010. This represents approximately 37.1 per cent of Australia's total greenhouse gas emissions, excluding the land use, land use change and forestry sector. Thus, there is an important role for the development of renewable energy generation projects in combating climate change.

Reducing greenhouse gas emissions is likely to be able to reduce the rate and magnitude of climate change. The Nyngan Solar Plant would produce an estimated 231,000 MWh per year of renewable electricity that would assist in meeting the LRET and providing a green house gas emission-free source of electricity to the Australian electricity grid.

2.3.2 Greenhouse gas emission benefits - life cycle analysis

When compared with existing conventional fossil-fuel based electricity generation, solar PV technology generates far less life-cycle air emissions per GWh than conventional fossil-fuel-based electricity generation technologies (Fthenakis *et al* 2008). Life cycle emissions take into account emissions produced during the manufacture, construction, operation and decommissioning of, in this case, electricity generation technologies. A comparison of life cycle CO_2 equivalent emissions for solar PV and conventional coal and gas powered electricity generation technologies is shown below in Figure 2-1.

During plant operation, the production of electricity with photovoltaic modules emits no pollution, produces no greenhouse gases, and uses no finite fossil-fuel resources (US Department of Energy 2004). Emissions from conventional fossil fuel based energy generation can therefore be avoided by replacing conventional methods of fossil fuel energy generation with solar PV energy generation. The proposed Nyngan Solar Plant is expected to supply approximately 231,000 MWh of electricity per year. Assuming a greenhouse gas (GHG) emissions rate of 0.88 tonnes per MWh (DCCEE 2012b), approximately 203,300 tonnes of CO_2 equivalent per annum would be avoided while the Nyngan Solar Plant is operational, as compared to fossil-fuel based energy generation.

Furthermore, Fthenakis *et al* (2008) found that manufacturing of thin-film cadmium telluride (CdTe) PV modules (as proposed for the Nyngan Solar Plant) results in lower air emissions than other PV technologies (such as traditional crystalline silicon) because less energy is required in the thin film manufacturing process.

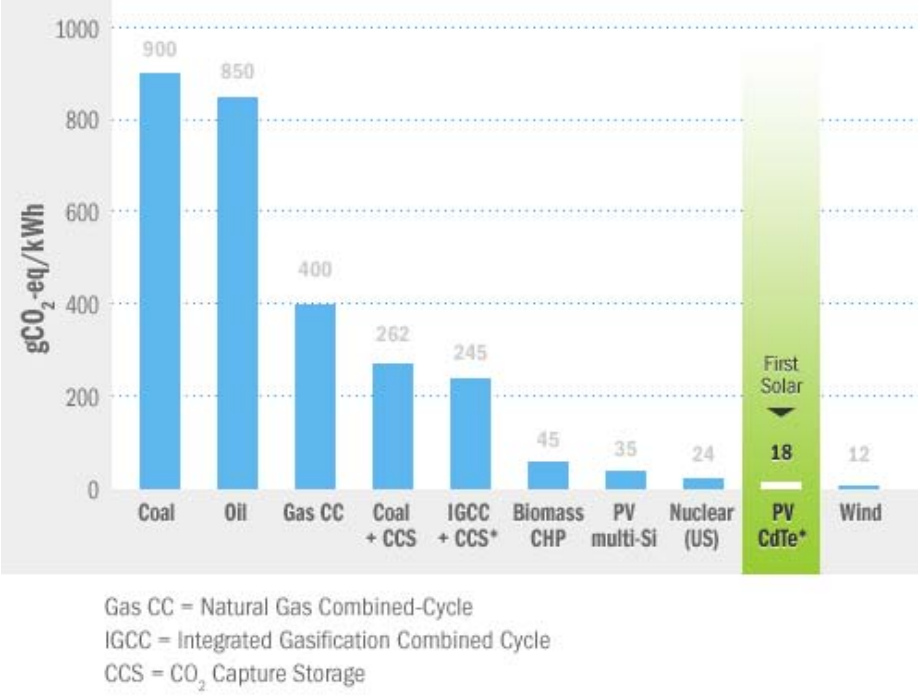


Figure 2-1 Comparison of life cycle CO_2 equivalent emissions for renewable and conventional fossil-fuel-based electricity generation technologies.

Source: First Solar (2012a)

2.4 NYNGAN SOLAR PLANT BENEFITS

The Nyngan Solar Plant would provide power to supply an estimated 33,000 average NSW homes, based on average NSW consumption of 7 MWh per year and an estimated annual production from the plant of 231,000 MWh per year. The solar plant would assist to:

- Demonstrate that large scale solar power plants can be constructed and operated within major electricity grids in Australia.
- Optimise the business models for constructing, generating and wholesaling electricity generated from large scale solar power plants.
- Develop the solar power industry and supply chain in Australia.
- Develop Australian intellectual property and know-how in solar power.
- Avoid approximately 203,300 tonnes of CO_2 equivalent per annum, by replacing fossil fuel based energy with solar generated energy.
- Assist in meeting NSW and Australian Government targets for renewable energy generation and reductions in greenhouse gas emission.

Specific to community benefits, the solar plant would:

- Generate approximately 300 local jobs and encourage regional development.
- Maximise the use of local contractors, manufacturing facilities and materials during construction, through liaison with local industry representatives.

In addition to socio-economic and employment benefits, the local community would benefit from AGL's support for community activities, including sponsorship of the 2013 and 2014 Nyngan Ag Expo and sponsorship of the Bogan Shire Christmas Lights competition.

2.5 ALTERNATIVES CONSIDERED

During the development of the Nyngan Solar Plant proposal, a number of alternative locations and infrastructure layouts were considered. Minimising environmental and social impacts and maximising efficiency were major considerations in the evaluation of alternative options. Alternative options considered include:

2.5.1 A single 150 MW solar plant

The successful AGL Solar Flagships proposal involves building two solar plants, one each at Nyngan and Broken Hill, with an aggregate nominal capacity of 150 MW. The option to build a single 150 MW solar plant at one site was assessed against the current proposal for two smaller solar plants at different sites. The benefits of a single large solar plant were assessed to be less optimal than two smaller plants, given that:

- Small solar plants require a smaller area of land which would have less impact on flora and fauna than a larger site.
- The local community is likely to be more accepting of a small solar plant than a large solar plant.
- It would allow for faster project development and construction times (again minimising environmental and social impacts during construction).
- Two smaller plants would provide the opportunity to better manage increasing peak demands during summer in multiple locations, rather than at only one location.

- Geographic diversity would reduce weather risk as operating two plants at different sites provides a natural hedge against transient cloud cover and weather systems since both sites are less likely to be impacted simultaneously by unfavourable weather.
- Job creation, skills transfer, and economic development would occur in two regional areas, rather than at only one location.

One large solar plant is therefore not the preferred option when compared to two smaller plants.

2.5.2 Alternative locations

In addition to the proposed solar plant sites at Nyngan and Broken Hill, AGL investigated site locations at Port Augusta in South Australia, and Mildura in Victoria. The solar resource at these locations is somewhat lower than Nyngan, making them less ideal for a solar plant.

In addition to its higher solar resource, the Nyngan site was identified as the preferred location for one of the solar plant sites, based on the following factors:

- Access to connect to the electricity grid.
- Availability of appropriate land.
- Suitability in terms of the interests of other stakeholders and the environment.

2.5.3 Alternative site layout at Nyngan

AGL previously investigated using the parcels immediately to the south of the current proposed site, as well as a parcel of property to the southeast across the Barrier Highway. A Preliminary Environmental Assessment (PEA) was submitted with regard to these locations for a 100MW plant. However, based on further investigation of potential hydrological impacts, AGL selected the current proposed location to reduce the potential for flooding to impact the solar plant.

Further 'micrositing' of infrastructure within the current proposed site was undertaken in response to hydrological and biodiversity constraints identified during the preparation of the EIS:

- The substation, control building and compound and parking areas would be in the south-west corner of the site.
- The north-south corridor of native trees in the centre of the site would be retained.

2.5.4 Alternative PV technologies

A number of different PV technologies, including mono- and multi-crystalline silicon, amorphous silicon, and copper indium diselenide were considered for use in the project. Based on an analysis of technology cost and performance, AGL selected First Solar's cadmium telluride (CdTe) thin film technology for the project.

While crystalline silicon PV cells are the most common PV cells in use today (US Department of Energy 2012), there are notable benefits in using First Solar's CdTe thin film PV technology at the Nyngan Solar Plant. In a life cycle analysis of PV technologies, Fthenakis *et al.* (2008) show that CdTe thin film technology produces the least amount of GHGs (refer Figure 2-2) and harmful atmospheric heavy metal emissions on a life cycle basis.

First Solar (2012c and 2012d) advises of the benefits of their advanced thin film solar module technology:

- Outperforms conventional solar modules with equal power rating

- Proven energy yield advantage over conventional solar modules in hot climates
- Manufacturing cost leader at under $0.67/watt (Q3 2012)
- Industry's first pre-funded collection and recycling program
- Smallest carbon footprint of any PV system

Additionally, CdTe reportedly has the fastest energy payback time of current PV technologies at less than 1 year (First Solar 2012e), and is a world record holder for CdTe PV cell efficiency (17.3%) (First Solar 2012f).

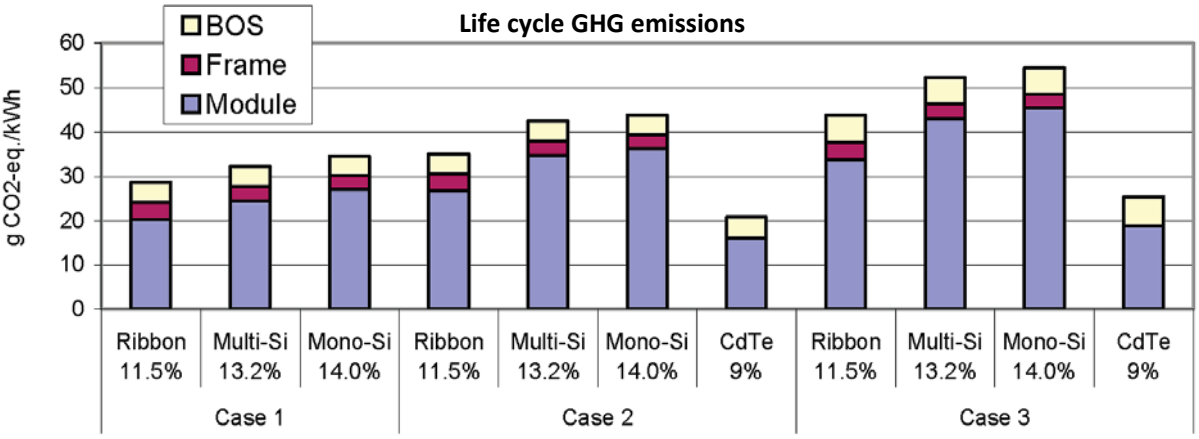


Figure 2-2 Life cycle GHG emissions from silicon and CdTe PV modules.

Source: Fthenakis et al (2008).

Notes: BOS is the Balance of System (i.e., module supports, cabling, and power conditioning). Conditions: ground-mounted systems, Southern European insolation, 1700 kWh/m2/yr, performance ratio of 0.8, and lifetime of 30 years. Case 1: current electricity mixture in Si production - CrystalClear project and Ecoinvent database. Case 2: Union of the Co-ordination of Transmission of Electricity (UCTE) grid mixture and Ecoinvent database. Case 3: U.S. grid mixture and Franklin database.

2.5.5 The 'do nothing' option

The consequences of not proceeding would be to forgo the benefits of the project, resulting in:

- Loss of opportunity to reduce greenhouse gas emissions and move towards cleaner electricity generation.
- Loss of a renewable energy supply that would assist the Commonwealth Government to reach the RET of 20 per cent by 2020, and the NSW Government to achieve the objectives set out in the draft NSW Renewable Energy Action Plan.
- Loss of additional electricity generation and supply into the Australian grid.
- Loss of social and economic benefits through the provision of direct and indirect employment opportunities during construction and operation of the solar plant.

Doing nothing would avoid environmental impacts associated with the development and operation of the proposed Nyngan Solar Plant, which include clearing of vegetation, construction noise, traffic and dust, visual impacts and a temporary reduction in agricultural production at the site. However, these impacts are considered to be manageable and would not result in a significant impact to the environment. As such, and given the benefits of the proposal, the do nothing option is not considered to be a preferred option. In light of the benefits of the proposal and the low level of environmental impact, the proposal is considered to be ecologically sustainable.

3 DESCRIPTION OF THE PROPOSAL

3.1 PROPOSED LOCATION

The proposal site is located approximately 10 kilometres west of Nyngan, NSW, within the Cobar Peneplain Bioregion. Nyngan is approximately 460 kilometres northwest of Sydney. The site is within the Central West Catchment Management Authority (CMA) jurisdiction and the Bogan Shire LGA. The local area is characterised by rural activities on large holdings. Population density is low.

The key infrastructure components proposed include a solar plant consisting of multiple PV arrays (and associated infrastructure), a substation and an electricity transmission line. The solar plant would be located on one land parcel, north of the Barrier Highway (Lot 34, DP751328) covering approximately 300 hectares within a total lot area of approximately 460 hectares. The site elevation is 175 - 178 metres Australian Height Datum (AHD). The site is currently used for agriculture (cropping and grazing). A farm dam and water tank are present at the site. No significant infrastructure is currently located at the site.

The transmission line would be approximately 3 kilometres in length. Five land parcels would be traversed by the line; three private rural land holdings (Lots 24 and 34 in DP751328 and Lot 8, DP724628), one Crown Land parcel (Lot 7300, DP1156652) and the Barrier Highway Road Reserve. The 40 metre wide transmission easement would cover approximately 14 hectares.

Land tenure

AGL proposes to purchase the land on which the solar plant site is located, while an easement would be created south of the solar plant substation for the transmission line and main access road. It is noted that while AGL would construct the transmission line, Essential Energy would own and maintain the line once built.

3.2 PROPOSED INFRASTRUCTURE COMPONENTS

3.2.1 Key infrastructure components: overview

The project involves the installation of a solar plant with a capacity of up to approximately 106 MW, including the following elements:

- Photovoltaic (PV) modules using cadmium telluride (CdTe) thin film technology.
- Inverters and step-up transformers to convert direct current (DC) electricity produced by the PV modules into alternating current (AC) capable of being connected to the electrical grid.
- Aboveground and underground electrical conduits and cabling to connect the modules to the inverters and transformers.
- Marshalling switchgear to collect the power from the modules.
- 33kV/132kV transformer substation and switchgear.
- A site office and maintenance building.
- A main access road from the Barrier Highway to the solar plant for construction and operational access.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing and landscaping.
- 132kV transmission line to connect into existing electrical network.

An indicative infrastructure layout is provided in Figure 1-1 above and a site plan is provided in Appendix E. Detailed discussion of infrastructure components is provided below.

3.2.2 Solar plant

The solar plant would comprise a series of solar PV modules, mounted on a steel racking frame supported by posts driven into the ground, installed in regular arrays of approximately 1.26 MW (AC) in size and aggregated to a combined plant capacity of up to approximately 106 MW (AC).

Photovoltaic modules

The solar plant would be constructed using First Solar CdTe thin film 87.5 watt (or greater, up to 95 watt) Series 3 PV modules. These modules:

- Produce high energy output across a wide range of climatic conditions with excellent temperature response coefficients.
- Have frameless laminate that is robust, cost-effective and recyclable, and does not require module grounding.
- Are manufactured in highly automated, state-of-the-art facilities certified to ISO 9001:2008 and ISO 14001:2004 quality and environmental management standards.

The FS Series 3 PV module data sheet is provided as Appendix B.

The PV module dimensions are 1200 mm x 600 mm x 6.8 mm. Each module weighs 12 kilograms. The modules are frameless and are encapsulated within a laminate material consisting of 3.2 mm heat strengthened front glass laminated to 3.2 mm tempered black glass.

Figure 3-1 FS Series PV Module front and back design.

(Source: First Solar 2012b).

Module arrangement and mounting

Subject to final design, the PV arrays would be installed at a zero degree north azimuth and a fixed tilt from horizontal of 25 degrees. Subject to final design, the solar plant would be built in standard 1.26 MW AC arrays (1.6 MW DC), as shown in Figure 3-2.

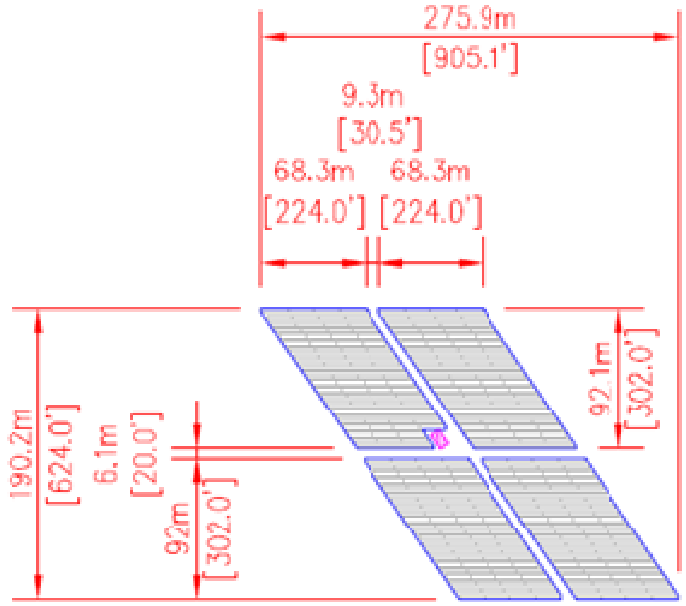


Figure 3-2 Typical 1.26MW AC solar array.

The PV mounting structure would comprise steel posts driven approximately 1.5 metres below ground using a post driver. Module racking tables would be installed on the vertical steel posts. The modules would be fixed to the tables with (indicatively) 4 rows of modules installed in landscape mode. Electrical cabling would be attached beneath the modules. Figure 3-3 shows a plant under construction in the United States showing posts, racking and modules installed in landscape position.

Figure 3-3 First Solar modules and racking tables.

Each 1.26 MW AC array would integrate (indicatively) one 1,100 Vdc to 690 Vac 1400 kVA inverter to transform the DC current produced by the modules into AC current that can be fed into the grid network. One 690/33kV 1.4MVA transformers would also be used in each 1.26 MW AC array to transform the energy to reticulation voltage. The inverters and transformers would be installed on a pad-mounted kiosk.

The transformers would feed into 33kV reticulation cables that would be connected to the combining switchgear installed in the project switchyard. The switchgear would connect to a 33/132kV substation that would transform the energy to grid voltage.

3.2.3 Underground cabling

All underground cabling would be installed in trenches, generally measuring approximately 800mm deep by 600mm wide. A sand bed would be placed under the cabling. Once the cables are installed, the cables would be covered by a layer of sand and the trench backfilled with existing fill. Cables would be mechanically protected in accordance with AS 3000. Buried cables would have a nylon jacket for termite protection.

3.2.4 Site buildings and amenities

A permanent operations and maintenance building would be installed at the south-western corner of the solar plant site. The building would be a prefabricated steel ATCO hut or similar, with a floor space of approximately 75m^2. It would incorporate a rigid base frame to support the building structure. The building would be placed on concrete foundations to provide appropriate elevation. A septic system would be installed and maintained in accordance with Council requirements. Drinking water would be supplied by bottled water, while non-potable water for sanitary requirements would be provided from an existing on-site dam or rainwater tanks.

3.2.5 Substation

A substation would be located near the south-western corner of the site. Power generated in the solar plant would be transformed in the substation to grid voltage via a 33/132kV transformer. A 132kV transmission line would connect from the substation to the existing Nyngan – Cobar 132kV transmission line. The substation would feature a busbar, circuit breakers, current transformers, voltage transformers, and a 33/132kV transformer. It would be surrounded by security fencing and gravel, to restrict vegetation growth. The substation would be divided into two separately-fenced sections, with one section owned and operated by AGL, and one section owned and operated by Essential Energy.

3.2.6 Access and car parking

A 6 metre wide approximately 1.6 kilometre long main access road would be located within the proposed transmission line easement (refer Figure 1-1) and would service both construction and operational traffic. It would be an unsealed, all-weather, compacted gravel road. An existing farm track is present in this location, but may require improvement with crushed rock. The location and form of the main access road intersection with the Barrier Highway would provide adequate sightlines (approximately 350 metres) when vehicles enter and exit the site. The intersection would be located approximately 90 metres east of the southwest corner of Lot 24, DP751328.

Internal solar plant access tracks would be required to access the modules onsite for maintenance. These would be 6 metre wide compacted but unsealed tracks and would be maintained throughout the construction and operation of the facility.

The carpark would be located within site boundaries in the south western corner of the site. It would be of sufficient capacity for all staff vehicles and equipment during peak construction phase and would occur on native soil.

Additionally, external access is required to construct and maintain the new transmission line to the south of the Barrier Highway. The access track along the transmission line south of the Highway (approximately 1.2 kilometres) would be native soil and would be approximately 5 metres wide.

If required, water trucks would be used to suppress dust on unsealed access tracks during construction. Stabilising techniques and/or environmentally acceptable dust palliatives would be utilised if the wetting down of surfaces proves to be ineffective.

3.2.7 Fencing

The site boundary would be protected by perimeter security fencing. Type 2-Y-B/B-T security fencing would be used which includes top and bottom rails and three barbed wires along the top (example shown in Figure 3-4). Fencing would feature a single support cable, chain link light or heavy duty fabric, galvanised pipe top and bottom rails, straight linked posts and corner posts with galvanised steel caps and concrete footings to secure the posts. Concrete footings would be installed to a depth of 750 mm. The fence height would be 2370 - 2970 mm, which would include 450 mm of barbed wire and 1800, 2100 or 2400 mm of chain link fabric installed from a height of 120 mm above the ground.

Double gates would be constructed at access points across the site. Gates would be 6 metres wide with galvanised plain bar drop bolts to secure the gates at ground level. A galvanised chain would be welded to the gate frame to use for padlocking. Concrete foundations for the gates would be installed to a depth of 1 metre.

Figure 3-4 Typical fencing to be used.

3.2.8 Transmission line

A new overhead transmission line and easement would be established to transmit energy generated at the solar plant to the electricity grid. The transmission line would be constructed over a length of approximately 3 kilometres from the south west corner of the solar plant site, extending due south to connect into the existing Nyngan – Cobar 132kV transmission line.

The transmission line would be a double circuit 132kV line with each circuit comprising three sets of conductors (wires), earth wire and potentially communications cables. Conductors would be attached to approximately 25 metre high spun concrete poles spaced approximately 150 - 250 metres apart. An example of a spun concrete pole is provided in Figure 3-5.

Vegetation within the electricity easement would be maintained to manage fire risk and allow maintenance. The easement would be 40 metres wide, in accordance with Essential Energy requirements (Essential Energy 2011).

Figure 3-5 Example of spun concrete pole.

3.3 PROJECT PHASES

3.3.1 Indicative timeline

An indicative timeline for the proposal is outlined in Table 3-1, subject to approval and obtaining all required licenses and permits.

Table 3-1 Indicative timeline.

Phase	Approximate commencement	Duration
Construction	Mid 2014	Approximately 18 months
Commissioning	End 2015	-
Operation	End 2015	Approximately 30 years
Decommissioning	End 2045	To be determined

Activities to be carried out in each phase are discussed below.

3.3.2 Construction

The construction phase of the Nyngan Solar Plant is expected to last 18 months. The main construction activities would include:

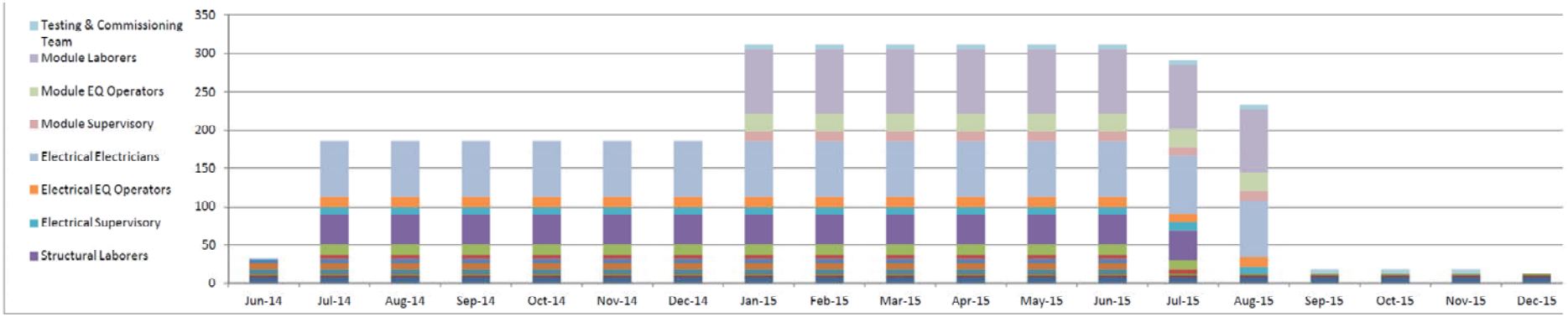
- Site establishment and preparation for construction (preliminary civil works and drainage, including access road construction).
- Installation of steel posts to provide support for the PV modules.

- Attachment of tilt brackets and rails which hold the PV modules.
- Connection of the PV modules to the brackets.
- Installation of the inverters and transformers.
- Trenching and wiring of underground cabling (DC and AC).
- Installation of PV switchgear and main transformer and connection to the new 132kV transmission line.
- Construction of the new approximately 3 kilometre transmission line and interconnection of the solar plant to the electricity grid.
- Commissioning and testing of the solar plant.
- Removal of temporary construction facilities and completion of restoration works.

The works would be divided in several stages. Some stages would be carried out simultaneously.

Civil works would be carried out first, including site access, drainage, the installation of environmental controls. Mechanical works would see the modules mounted, followed by electrical works, and finally commissioning of the solar plant. The grid connection would be completed prior to module installation to allow the plant to be progressively commissioned in approximately 25 MW blocks.

It is anticipated that approximately 300 construction personnel would be required on site during the peak construction period for the Nyngan Solar Plant (Figure 3-6). Key construction management staff would relocate to Nyngan for the duration of the construction phase. Construction supervisors and the construction labour force, made up of construction labourers and technicians, would be hired locally where possible. It is anticipated that most workers would be accommodated at existing accommodation within the local area. Work camps are not proposed.



Nyngan Staffing Estimate

	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15
Onsite Office Staff	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Project Supervisory	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Safety Team	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Site Prep Supervisory	2	2	2	2	2	2	2	2	2	2	2	2	2						
Site Prep EQ Operators	4	4	4	4	4	4	4	4	4	4	4	4	4						
Site Prep Laborers	8	8	8	8	8	8	8	8	8	8	8	8	8						
Site Prep Electricians	6	6	6	6	6	6	6	6	6	6	6	6	6						
Structural Supervision		6	6	6	6	6	6	6	6	6	6	6	6	6					
Structural EQ Operators		13	13	13	13	13	13	13	13	13	13	13	13	13					
Structural Laborers		39	39	39	39	39	39	39	39	39	39	39	39	39					
Electrical Supervisory		10	10	10	10	10	10	10	10	10	10	10	10	10	10				
Electrical EQ Operators		12	12	12	12	12	12	12	12	12	12	12	12	12	12				
Electrical Electricians		74	74	74	74	74	74	74	74	74	74	74	74	74	74				
Module Supervisory								12	12	12	12	12	12	12	12				
Module EQ Operators								24	24	24	24	24	24	24	24				
Module Laborers								83	83	83	83	83	83	83	83				
Testing & Commissioning Team								6	6	6	6	6	6	6	6	6	6	6	
Project Staffing Monthly Total	32	186	186	186	186	186	186	311	311	311	311	311	311	291	233	18	18	18	12

Labor count and mix is an estimate, final headcount may vary with skill sets
This headcount does not include FS employees working in the AUS or US offices on this project

Figure 3-6 Nyngan labour estimates and monthly headcount.

(Source: AGL)

Construction activities would be undertaken during standard daytime construction hours (7.00am to 6.00pm Monday to Friday and 7.00am to 1.00pm on Saturdays). Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.

3.3.3 Operation

It is anticipated that the Nyngan Solar Plant would commence operation at the end of 2015. Once operational, activities at the Nyngan Solar Plant would include:

- Daily operations and maintenance.
- Provision of site security.
- Periodic maintenance of vegetation inside the solar plant and along the transmission line easement.
- Replacement of infrastructure, as required.

The Nyngan Solar Plant is expected to operate for at least 30 years and would be fully decommissioned at the end of its operational life.

Approximately 2-3 maintenance personnel would be employed at the site to support routine plant operations and maintenance. Except in response to any unforseen incidents, standard work hours would be maintained.

3.3.4 Decommissioning

Key elements of project decommissioning would include:

- The PV power plant would be disconnected from the electrical grid.
- PV modules and all equipment would be disconnected.
- PV modules would be removed from racking and packaged for removal from the site.
- PV modules would be collected by First Solar and recycled at a dedicated recycling facility.
- All buildings and equipment would be removed and materials recycled, wherever possible.
- Racking would be disassembled and recycled.
- Posts and cabling would be removed and recycled.
- Fencing would be removed.
- Site rehabilitation.

All aboveground infrastructure would be removed from the site at the decommissioning phase. Infrastructure and materials removed from the site would be recycled or otherwise disposed of at approved facilities.

All areas of soil disturbed during decommissioning would be rehabilitated, appropriate to the existing species composition:

- In exotic dominated areas, exotic pasture species would be reinstated.
- In native dominated areas, native species would be reinstated.

Groundcover vegetation benchmarks would be established as part of pre-construction work to ensure that the site is left in as good or better condition, in terms of vegetation cover, after decommissioning.

Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase.

4 STAKEHOLDER CONSULTATION

4.1 AGENCY CONSULTATION

4.1.1 Development of the Director-General's Requirements (DGRs)

The DGRs are intended to guide the structure and content of the EIS, and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the solar plant. The DGRs are attached in Appendix A.

The following agencies were consulted by the DoPI during the development of the DGRs:

Table 4-1 Agency issues addressed by this EIS.

Agency	Issue summary	Addressed in this EIS
Central West Catchment Management Authority	Scope and assessment to address the solar plant and transmission line.	Sections 3,6,7
	Rehabilitation of the site. • Outline rehabilitation of the site after the project's operational phase, aimed at increasing the environmental values of site when compared to current condition. • Rehabilitation strategy to include employment of local people. • Strategy to outline ongoing environmental monitoring, post rehabilitation to minimise potential for future degradation.	Section 6.2
Department of Primary Industries (DPI) - Office of Water	Water supply, use and management: • Adequate and secure water supply. • Identification of site water demands, water sources (surface and groundwater), water balance and management. • Impact assessment on adjacent licensed water users (surface and groundwater), riparian ecosystems and groundwater dependent ecosystems. • Description and assessment of potential to intercept groundwater. • Impact assessment of proposed works within or adjacent to watercourses. • Existing and proposed water licensing requirements. • Adequate mitigating and monitoring requirements to address surface and groundwater impacts.	Section 7.9
DPI – Catchment and Lands Division	Crown Lands (within the Catchments and Lands Division of DPI) are to be noted as a key stakeholder and referenced accordingly.	Section 4.1.2
	The proponent will need to apply for a licence under the *Crown Lands Act 1989* for the purpose of "site investigation" over the affected part of Lot 7300 DP1156652 to authorise their use and occupation of the site prior to construction of the transmission line.	Section 4.1.2
	If approved the proponent must undertake action to create an easement over the affected part of Lot 7300 DP1156652, with compensation payable to the Crown under the provisions of the *Land Acquisition (Just terms compensation) Act 1991*.	Section 4.1.2
	Any Aboriginal Land Claims over the affected land will need to be fully investigated and determined.	Section 5.4.2

Agency	Issue summary	Addressed in this EIS
Environment Protection Authority	Noise (construction) EIS should include assessment of construction noise and reference relevant guidelines: • Interim Construction Noise Guideline (DECC 2009)	Section 6.5
	Noise (operation) EIS should include assessment of operation of the electrical substation and aeolian/corona noise from the transmission line. The assessment should consider relevant guidelines: • NSW Industrial Noise Policy (EPA 2000) • NSW Road Noise Policy (DECCW 2011) • Assessing Vibration: A Technical Guideline (DEC 2006).	Sections 6.5 7.5
	Surface Hydrology • Flooding impacts.	Section 6.4
	Water quality, waterways and flooding. The following guidelines should be considered: • Managing. Urban Stormwater: Soils and Construction, Volume 1, 4th edition (Landcom 2004), • Managing Urban Stormwater Soils and Construction, Volume 2A, Installation of Services and 2C Unsealed Roads (DECC 2008), and • National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).	Section 7.9
Office of Environment and Heritage	Natural conservation issues • Protection and care of native flora and fauna and the protection and management of reserves. • Conservation of threatened species of flora and fauna, populations and ecological communities.	Section 6.2
	Cultural Heritage issues • Protection and care of Aboriginal objects and places.	Section 6.3
Bogan Shire Council	Transport of construction materials: • All construction materials should be shipped by rail or alternatively road reconstruction be undertaken for turning trucks.	Section 7.5
	Erosion from surface water runoff from panels: • Consideration should be given to collect all surface water from panels to reduce erosion in the surrounding area.	Section 7.9
NSW Rural Fire Service	Bush fire planning and management issues • The below requirements of *Planning for Bush Fire Protection 2006* - o Identifying asset protection zones o Providing adequate egress/access to the site (s4.1.3) o Emergency evacuation measures (s4.2.7) • The ability to site and provide for adequate water supplies for bush fire suppression operations. • Development of operational procedures relating to the mitigation and suppression of bush fire relevant to the proposed development.	Section 7.7, 8.2

4.1.2 Additional agency consultation

The following agencies have also been consulted during the preparation of the EIS.

Local Aboriginal Land Council (LALC) and Bogan Aboriginal Corporation

The Nyngan LALC has been consulted as part of the Aboriginal heritage investigations, in accordance with OEH guidelines. Representatives of the Nyngan LALC and the Bogan Aboriginal Corporation participated in field investigations.

Details of additional consultation undertaken specifically in respect of Aboriginal heritage matters are provided in the Aboriginal Cultural Heritage Assessment Report in Appendix D.

Roads and Maritime Services (RMS) and local police

The RMS and local police force representatives have been consulted regarding traffic impacts and upgrades (Bogan Shire Council Traffic Committee Meeting, August 9, 2012). AGL met with RMS officers at the site on 29 August 2012.

Bogan Shire Council

Bogan Shire Council (D. Francis, General Manager) provided a letter of support to AGL on 17 February 2012. The letter applauded the Solar Flagships Program and notes that Council was committed to supporting AGL develop renewable energy in the Shire. Additionally, AGL met with Bogan Shire Council on 9 July 2012 and with Council officers on 29 August 2012, and has continued to consult with the Council during development of the proposal.

Australian Energy Market Operator (AEMO)

AEMO manages the National Electricity Market (NEM). AGL met with AEMO on 27 February 2012 to discuss solar forecasting and information requirements for connecting a solar plant into the NEM.

Department of Primary Industries

AGL met with the Catchment & Lands Division of the Department of Primary Industries (DPI) on 6 June 2012 regarding the establishment of the transmission line easement for the 132kV line over the Crown Land parcel, south of Barrier Highway.

A licence under the *Crown Lands Act 1989* has been obtained for the purpose of "site investigation" over the affected part of Lot 7300 DP1156652 to authorise the proponent's use and occupation of the site prior to construction of the transmission line. An application for a transmission line easement is being prepared by Essential Energy on behalf of AGL.

NSW Office of Environment and Heritage

AGL contacted the Dubbo office of the NSW Office of Environment and Heritage (OEH) in August 2012 to discuss potential flora and fauna issues at the site, and the proposed approach for surveying site flora and fauna.

Essential Energy

AGL have consulted with Essential Energy on a number of occasions regarding electricity connections for the Nyngan Solar Plant. Discussions have included technical issues associated with connecting an approximately 100 MW generator at Nyngan, commercial issues associated with the connection agreement and potential interconnection of the Nyngan Solar Plant with the existing Nyngan – Cobar line.

Meetings and telephone discussions were held in 2010, 2011 and more recently on 20 March 2012, 25 June 2012, 20 September 2012, and 19 October 2012.

Cobar Shire Council

AGL has consulted with the Cobar Shire Council regarding provision of water from the Cobar Water pipeline for dust suppression during construction of the solar plant. AGL had a telephone discussion with the General Manager of the Cobar Shire Council on 24 September 2012, as well as email discussion on 4 October 2012 and 20 December 2012.

State Water Corporation

AGL has consulted with the State Water Corporation regarding purchase of water rights for water stored in Burrendong Dam. The Burrendong Dam supplies the Albert Priest Channel, which feeds the Bogan Weir at Nyngan. Water required for dust suppression during plant construction, if not sourced from collection of onsite runoff, would be supplied via the Bogan Weir. AGL had a telephone discussion with a representative of the State Water Corporation on 4 October 2012.

NSW Rural Fire Service (RFS)

The RFS has not been consulted regarding the proposal at this stage. As detailed in section 7.7, bush fire is not considered a key issue and a commitment is made to prepare a Bush Fire Management Plan for construction and operation of the project, in consultation with the RFS and addressing the specific issues that the RFS have raised in relation to the project.

Minerals stakeholders

No exploration licence is held over the site, as detailed in section 7.3. No consultation has been undertaken with regard to minerals stakeholders.

4.2 COMMUNITY CONSULTATION

4.2.1 Community Consultation Plan

A Community Consultation Plan was developed early in the planning stage of the Nyngan Solar Plant to provide a framework for a positive working relationship with the local community (Appendix D). The plan aims to:

- Provide an effective, meaningful and inclusive approach for community consultation activities.
- Identify and address potential risks regarding community acceptance and involvement with the project.

Specifically, the plan:

- Identifies key community stakeholder groups relevant to the proposal.
- Identifies risks and opportunities with regard to community consultation.
- Establishes a framework for a two-way flow of information between the stakeholders and AGL, throughout the assessment and submission process.

Key community stakeholder groups were identified as follows:

- Involved landholders.

- Nearby residents.
- Surrounding landowners, residents and community groups.
- Business operators and groups.
- Indigenous groups.
- Special interest groups such as sporting groups and wildlife groups.
- Broader community.

A range of specific risks, opportunities and activities were identified for each of these groups in the plan. The proposed activities are set out in the plan by stage of the project (assessment stage, public exhibition stage, submission of the final project for approval, construction stage and operational stage).

4.2.2 Community consultation activities to date

In accordance with the plan, several activities were undertaken prior to the lodgement of the public exhibition of the EIS, as detailed below. The results of the community consultation process are summarised in section 7.4 of the EIS.

Table 4-2 Consultation activities prior to public exhibition of the EIS.

Project stage	Stakeholder group	Activities (1-11)	Status
Early site investigations	Nearby residents	1. Face to face meetings to discuss specific issues.	AGL has met with all involved property owners several times during the development of the proposal.
	Broader community	2. Advertisement in local media to introduce the project and provide a contact.	*Advertisement placed in the Nyngan Observer on July 4, 2012.
	Broader community	3. Establish website for project updates.	Media release uploaded to the AGL website on June 9, 2012.
	Broader community	4. Briefing local council members.	*Letter of support obtained from Council February 17, 2012.
	Aboriginal community	5. Archaeologist to commence notification process prior to any field assessment.	*Notification for the purpose of seeking an Aboriginal Heritage Impact Permit, if required, commenced June 20, 2012 (refer to section 6.3 for details).
	Broader community	6. Open house to present results of early investigations and seek community input.	*AGL manned a booth at the Nyngan Ag Expo on August 4, 2012.
	Broader community	7. A feedback form prompting community input.	*Forms disseminated via Activities 2, 6 and 10.
	Nearby residents, special interest groups	8. Face to face meetings to discuss specific issues.	None requested, as of August 2012.

Project stage	Stakeholder group	Activities (1-11)	Status
Detailed assessment and refinement of project description	Broader community	9. Second open house if required.	A booth may be manned at the 2013 Ag Expo to update community on project development (which would be approx 8 months prior to construction start)
	Broader community	10. Disseminate newsletter updates / fact sheets / FAQs regarding key issues.	*Forms disseminated by mail, July 18, 2012 and at Nyngan Ag Expo on August 4, 2012.
	Broader community	11. Maintain website with project updates.	Project website launched in August 2012: http://agk.com.au/nyngan/

* Records of these activities are provided in Appendix C.

5 PLANNING CONTEXT

5.1 ASSESSMENT CONTEXT

The proposal to construct and operate the Nyngan Solar Plant requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Section 89C of the EP&A Act provides that development will be State Significant Development (SSD) if it is declared to be SSD by a State Environmental Planning Policy (SEPP).

State Environmental Planning Policy (State and Regional Development) 2011 declares the Nyngan Solar Plant to be SSD as it is development for the purpose of electricity generating works with a capital cost of greater than $30 million (clause 20, Schedule 1). This is considered further in section 5.2.1 below.

Section 78A of the EP&A Act requires a development application for SSD to be accompanied by an EIS prepared in accordance with the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulations).

On 15 June 2012, the proponent wrote to the Director-General as required by clause 3 of Schedule 2 of the EP&A Regulations, requesting the Director-General's environmental assessment requirements for the proposed Nyngan Solar Plant. The proponent's request was accompanied by a Scoping Study, which provided detailed information about the proposed project including key environmental issues. In formulating the environmental assessment requirements, the Director-General consulted with relevant public authorities and agencies and considered key issues raised by those authorities (see section 4.1).

On 24 July 2012, the Director-General notified the proponent of the environmental assessment requirements for the Nyngan Solar Plant.

This EIS complies with the Director-General's environmental assessment requirements and the environment assessment requirements contained in Schedule 2 of the EP&A Regulations.

The Minister for Planning and Infrastructure is the consent authority for the Nyngan Solar Plant. However, the Minister has delegated the consent authority function to the Planning Assessment Commission (PAC) under the terms of a delegation dated 14 September 2011.

5.2 EVALUATION OF THE DEVELOPMENT

Section 89H of the EP&A Act provides that section 79C applies to the determination of development applications for SSD.

Under section 79C of the EP&A Act, the consent authority is required to consider a number of matters when determining a development application under Part 4. These matters include:

- The provisions of:
    - any environmental planning instrument;
    - any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority;
- Any development control plan;
- Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F;
- The regulations (to the extent that they prescribe matters for consideration);

- Any coastal zone management plan (within the meaning of the Coastal Protection Act 1979), that apply to the land to which the development application relates;
- The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;
- The suitability of the site for the development;
- Any submissions made in accordance with this Act or the regulations; and
- The public interest.

Each of these matters are considered further below.

5.2.1 The provisions of any environmental planning instrument

The following environmental planning instruments include provisions relevant to the project:

- *SEPP (State and Regional Development) 2011*
- *SEPP (Infrastructure) 2007*
- *SEPP No. 55 – Remediation of Land*
- *Bogan Local Environmental Plan 2011*

SEPP (State and Regional Development) 2011

The aims of the State and Regional Development SEPP (SRD SEPP) are to identify development that is SSD, to identify development that is State Significant Infrastructure and Critical State Significant Infrastructure and to confer functions on joint regional planning panels to determine development applications.

State Significant Development

Clause 8 of the SRD SEPP provides that development is declared to be State Significant Development for the purposes of the EP&A Act if:

- the development is not permissible without consent under Part 4 of the EP&A Act; and
- the development is specified in Schedule 1 or 2 of the SRD SEPP.

Clause 20 of Schedule 1 of the SRD SEPP provides:

> *"Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that:*
>
> *(a) has a capital investment value of more than $30 million, or*
>
> *(b) has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance."*

The Nyngan Solar Plant is a development for the purpose of electricity generation and would have a capital investment value in excess of $30 million. Accordingly, the Nyngan Solar Plant is declared to be SSD for the purposes of the EP&A Act.

SEPP (Infrastructure) 2007

The SEPP (Infrastructure) was introduced to facilitate the effective delivery of infrastructure across the State by improving regulatory efficiency through a consistent planning regime for infrastructure and services across NSW.

Clause 34(7) of the SEPP provides that development for the purpose of 'solar energy systems' may be carried out with consent on any land, except as prescribed by subclause 34(8). Permissibility of the project is discussed in further detail in the section regarding the Bogan Local Environmental Plan 2011 below.

Traffic generating development

Clause 104 of the SEPP requires certain developments (identified in Column 1 of the Table in Schedule 3) to be referred to RMS (known as traffic generating development). The consent authority would then be required to take into account any submission made by RMS in relation to the development.

Power generation is not included in column 1 in the Table. Section 104 of the SEPP applies to other development where there are 200 or more motor vehicles. Since the project would result in the generation of fewer than 200 vehicles per day during construction or operation, the requirements under clause 104 of the SEPP do not apply.

SEPP No. 55 - Remediation of Land

SEPP No. 55 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. The SEPP applies to the whole of the State.

Clause 7 of the SEPP No. 55 requires that the remediation of land be considered by a consent authority in determining a development application.

A search of the Office of Environment and Heritage contaminated land public record (OEH 2012a) was undertaken for contaminated sites within the Bogan Shire LGA on 18 July 2012. There were no records returned. The online *List of NSW contaminated sites notified to EPA* (OEH 2012b) was also searched on 17 October 2012. Three sites were found in the Nyngan area, however all three were service station sites located within the Nyngan township.

There is a risk that contamination associated with agricultural activities (e.g., pesticides) could be present on the site however, given no contaminated sites are recorded on or adjacent to the proposed development and that no evidence of contamination was observed during the site visit or mentioned during conversations with the land owner, it is considered highly unlikely that significant contamination exists in areas that would be affected by the proposal. Furthermore, the construction activities would not significantly disturb soil or groundwater at the site.

Bogan Local Environmental Plan 2011

The site is located within the Bogan Local Government Area and is subject to the Bogan Local Environmental Plan 2011 (LEP). The LEP aims:

a) *to protect, enhance and conserve agricultural land through the proper management, development and conservation of natural and man-made resources,*
b) *to encourage a range of development, including housing, employment, recreation and community facilities, to meet the needs of existing and future residents of Bogan,*
c) *to promote the efficient and equitable provision of public services, infrastructure and amenities.*

The LEP states that the consent authority must have regard to the development objectives of planning zones identified in the LEP when determining development applications. The proposal site lies within land

zoned RU1 - Primary Production. The transmission line is also located within this zone, but crosses Barrier Highway, zoned as SP2 – Classified Road.

RU1 Primary Production

The objectives of the RU1 zone are:

a) *to encourage sustainable primary industry production by maintaining and enhancing the natural resource base*

b) *to encourage diversity in primary industry enterprises and systems appropriate for the area*

c) *to minimise the fragmentation and alienation of resource lands*

d) *to minimise conflict between land uses within this zone and land uses within adjoining zones.*

For the life of the project, the proposal would harness a natural resource (solar energy). While the activity would impact on land availability for primary production, the land would meet objects b) and c) as identified above; it would allow for diversity in land use, appropriate to the area and it would not fragment resource lands. Being fully reversible and involving limited ground disturbance, it would not remove the potential to use the land for primary production in the long term.

SP2 Infrastructure

The objectives of the SP2 zone are:

a) *to provide for infrastructure and related uses*

b) *to prevent development that is not compatible with or that may detract from the provision of infrastructure.*

The LEP allows, with consent, development that is ordinarily incidental or ancillary to development for the purpose shown on the land zoning map (classified road).

Permissibility

Electrical generation is prohibited in both the RU1 Zone and SP2 Infrastructure Zone.

However, clause 34(7) of SEPP Infrastructure provides that development for the purpose of 'solar energy systems' may be carried out with consent on any land, except as prescribed by subclause 34(8).

Solar energy systems include a photovoltaic electricity generating system. Clause 34(8) of the SEPP states that development for the purpose of a photovoltaic electricity generating system may be carried out by a person with consent on land in a prescribed residential zone only if the system has the capacity to generate no more than 100 kW. As the proposed project site is not in a prescribed residential zone, clause 34(8) does not apply.

Section 36 of the EP&A Act provides that where there is an inconsistency between environmental planning instruments, there is a general presumption that a State environmental planning policy prevails over a local environmental plan or other instrument made before or after that State environmental planning policy. Clause 8 of SEPP Infrastructure relevantly provides that if there is an inconsistency between SEPP Infrastructure and any other environmental planning instrument, whether made before or after the commencement of SEPP Infrastructure, SEPP Infrastructure prevails to the extent of the inconsistency.

Accordingly, the Nyngan Solar Plant is permissible with consent.

The provisions of any development control plan

Bogan Shire Council has prepared a *Draft Bogan Shire Council Development Control Plan 2012*, however it is yet to be adopted.

Clause 11 of the SRD SEPP provides that development control plans do not apply to state significant development.

The provisions of any planning agreement that has been entered into

There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the Nyngan Solar Plant.

The provisions of the EP&A Regulations

Clause 92 of the EP&A Regulations requires consideration of:

- the Government Coastal Policy, for development applications in certain local government areas; and
- the provisions of AS 2601 for development applications involving the demolition of structures.

Neither of these provisions is relevant to the Nyngan Solar Plant. In particular, the Nyngan Solar Plant is not within one of the LGAs identified in the EP&A Regulations (and is outside the Coastal Zone) and demolition of structures is not proposed.

The likely impacts of the development, including environmental impacts on both the natural built environments, and the social and economic impact in the locality

The likely impacts of the Nyngan Solar Plant, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in sections 6 and 7 of this EIS. This EIS demonstrates that the environmental impacts of the Nyngan Solar Plant have been avoided or minimised through careful project design. Specifically,

- No significant infrastructure is currently located at the site and visual impacts of the proposal would be low for surrounding features (two non-involved local residences, vehicles in transit along the Barrier Highway).
- Biodiversity features of conservation value have been avoided and offsetting would be undertaken to offset the residual impacts of the development on native vegetation and habitat.
- Community consultation demonstrated most respondents were in favour of the proposal. Furthermore, several socio-economic benefits would be achieved through the provision of direct and indirect employment opportunities, during both construction and operation of the solar plant.

Suitability of the site for the development

The proposal site has a number of characteristics that make it suitable for development of a solar plant, including:

- High potential for solar energy production with an average daily solar exposure range of 18-21 megajoules per square metre.
- Consistent solar access, with few to no obstructions shading the site.
- Nearby access to the existing electrical grid infrastructure.

- Flat site topography and geotechnical conditions that allow for a low impact module mounting structure and layout.
- Relatively distant location from sensitive receivers (approximately 2.3 kilometres), reducing potential for noise and visual amenity impacts during all project phases.
- Low biodiversity values generally, and the ability to retain higher value areas, by careful siting of infrastructure and management prescriptions.

Further, the proposal is viewed as largely reversible; at the end of the project all above ground infrastructure would be removed and current agricultural land use activities could resume or other land uses in the area, such as residential development or mining, could be considered.

Any submissions made on the development

AGL would consider and respond to any submissions made in relation to the Nyngan Solar Plant.

The public interest

The Nyngan Solar Plant is in the public interest for a number of reasons. On an annual basis the plant would produce approximately 231,000 MWh per year, which would provide energy for approximately 33,000 average NSW homes, based on average NSW consumption of 7 MWh per year. The solar plant would also assist to:

- Generate local approximately 300 jobs and encourage regional development.
- Avoid approximately 203,300 tonnes of CO_2 equivalent per annum by replacing fossil fuel based energy with solar generated energy, reducing emissions that contribute to climate change.
- Assist in meeting State and Australian Government policies to increase renewable energy supply in Australia.
- Develop the solar power industry and supply chain in Australia, increasing the potential for job creation and environmental benefits that are associated with renewable energy supply across a broader area.

Community consultation demonstrates there is support for the proposal in the local community (refer section 7.4). Additional proposal benefits, including sponsorship of community activities, are discussed in section 2.4.

5.3 NSW LEGISLATION

5.3.1 Environmental Planning and Assessment Act 1979

Development in NSW is subject to the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and its associated regulations. Environmental planning instruments prepared under the Act set the framework for development approval in NSW.

The project would be assessed under Part 4 of the EP&A Act. The relevant objects of the EP&A Act are:

a) to encourage:

i. The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.

ii. The promotion and coordination of the orderly and economic use and development of land.
iii. The protection, provision and coordination of communication and utility services.
vi. The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.
vii. Ecologically sustainable development.

c) Increased opportunity for public involvement and participation in environmental planning and assessment.

The objects of the EP&A Act have been considered throughout this environmental assessment. The project aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The project has been located and designed such that it would avoid protected areas and generally minimise the use of natural and artificial resources while still promoting the social and economic welfare of the local community.

The proposal is not inconsistent with the remaining objects of the Act:

a) To encourage:

i. the provision of land for public purposes
ii. the protection, provision and co-ordination of communication and utility services.
iii. the provision and maintenance of affordable housing.

b) To promote the sharing of the responsibility for environmental planning between the different levels of government in the State.

Given the proposal would support a number of the objects of the EP&A Act, and is not inconsistent with the remaining objects of the Act, the proposal is considered appropriate in the context of the EP&A Act.

Environmental Planning and Assessment Regulations 2000

Division 6 of the EP&A Regulations addresses public participation in State Significant Development. AGL would comply with Division 6 of the EP&A Regulations, including the specific provisions of clauses 84 and 85 regarding placing notice local newspaper and on the website of the Department of Planning and Infrastructure and the form that notice must take. The Development application and accompanying information (including this EIS) will be placed on public exhibition for a period not less than 30 days.

5.3.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the NSW Office of Environment and Heritage (OEH).

Under section 48 of the POEO Act, premises-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). Clause 17 of Schedule 1 of the POEO Act concerns electricity generation works. General electricity works is a scheduled activity and requires an EPL where the activity has the capacity to generate more than 30 MW of electrical power. General electricity generation works is defined as "the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power". Although the works have a capacity to generate more than 30 MW of electrical power, electricity

generation from solar power is not a scheduled activity. Accordingly, an EPL is not required under the POEO Act for the proposed solar plant.

Nevertheless, any water pollution resulting from the proposed development that is not in accordance with an EPL would constitute a breach of the Act under section 120. Under section 148 of the Act, the proponent would be required to notify the OEH of any pollution incidents that occur as a consequence of the construction or operation of the proposed development.

5.3.3 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the classification of roads and for the declaration of the Roads and Maritime Services (RMS) and other public authorities as roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads. The proposed 132kV transmission line would cross the Barrier Highway, which has the potential to disrupt traffic during construction. Approval from the RMS or the local council would be required under section 138 of the Roads Act to erect a structure or carry out a work in, on or over a public road.

5.3.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation. Clearing is defined as cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation including native grasses and herbage. However, an authorisation to clear native vegetation is not required for State Significant Development (section 89J *Environmental Planning and Assessment Act 1979*).

5.3.5 Threatened Species Conservation Act 1996

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. The TSC Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.

The potential to impact threatened species, populations and ecological communities listed under this act has been considered in section 6.2 of this EIS (and in full, Appendix D).

5.3.6 National Parks and Wildlife Act 1974

Under the *National Parks and Wildlife Act 1974*, the Director-General of the NPWS is responsible for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves. The Director-General is also responsible under this legislation for the protection and care of native fauna and flora, and Aboriginal places and objects throughout NSW.

The provisions of the Act have been considered for this project. The project is not in or in the vicinity of any protected areas as defined in the Act. The key findings of the Biodiversity Assessment undertaken for the project are outlined in section 6.2 of the EIS (and in full, Appendix D).

An assessment of impacts to Aboriginal Heritage is provided in section 6.3 of the EIS (and in full, Appendix D). An Aboriginal Heritage Impact Permit under section 90 of the National Parks and Wildlife Act is not required for State Significant Development (section 89J *Environmental Planning and Assessment Act 1979*).

5.3.7 Crown Lands Act 1989

The objective of the Crown Lands Act is to ensure that Crown land is managed for the benefit of the people of New South Wales. The Catchments and Lands Division, Department of Primary Industries (DPI) is responsible for the sustainable and commercial management of Crown land. This involves the management of state-owned land, linking with other agencies, local government, the private sector and communities to provide social and economic outcomes for NSW.

Part of the proposed works traverses Crown land on Lot 7300 DP1156652. The proponent is currently liaising with DPI to gain required approvals (refer also section 4.1.2).

5.3.8 Aboriginal Land Rights Act 1983

The *Aboriginal Land Rights Act 1983* provides a mechanism for compensating Aboriginal people of NSW for loss of their land. The role of the Department of Aboriginal Affairs is to administer the Act on behalf of the Minister for Aboriginal Affairs.

An Aboriginal Lands Claims search in relation to the Crown Land Lot 7300 DP 1156652 was submitted to the Office of the Register on 2 July 2012. The results, received 17 July 2012, advised that the subject lot did not appear on the register as being affected by an Aboriginal Land claim pursuant to section 36 or 37 of the *Aboriginal Land Rights Act 1983*. However, subsequent advice from the Department of Primary Industries' Catchment and Lands Division to DoPI, in late November and early December 2012, advised that local records indicated that Aboriginal Land Claim 7409 may apply to part lot 7300 DP1156652 and was yet to be determined. It is understood claim 7409 is made in respect of a Travelling Stock Reserve (TSR), which includes Lot 7300 DP1156652.

Accordingly, the Proponent engaged with the Claimant, the Nyngan Local Aboriginal Land Council (Nyngan LALC). The Nyngan LALC has subsequently provided consent for the compulsory acquisition of an easement that will permit the transmission line to cross Lot 7300 DP 1156652, and has expressed strong support for the proposal.

5.4 COMMONWEALTH LEGISLATION

5.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). Under the EPBC Act, if the Minister determines that an action is a 'controlled action' which would have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval of the Minster. The EPBC Act identifies eight MNES:

- World Heritage properties.
- National heritage places.
- Ramsar wetlands of international significance.
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.

- Nuclear actions (including uranium mining).

When a person proposes to take an action that they believe may be a 'controlled action' under the EPBC Act, they must refer the proposal to the Department for a decision about whether the proposed action is a 'controlled action'.

A search for MNES and other matters protected by the EPBC Act was carried out within a 10 kilometre radius of the proposed solar plant site using the Commonwealth online Environmental Reporting Tool (report created 4 July 2012). A summary of the findings is provided in the tables below, which also indicate the relevant sections of the EIS where these matters are addressed.

Table 5-1 Summary of Matters of National Environmental Significance (10 km search radius).

Matters of National Environmental Significance	No.	Addressed in this EIS
World Heritage Properties	None	NA
National Heritage Places	None	NA
Wetlands of International Significance	None	NA
Great Barrier Reef Marine Park	None	NA
Commonwealth Marine Areas	None	NA
Threatened Ecological Communities	3	Section 6.2 and discussion below
Threatened Species	9	Section 6.2 and discussion below
Migratory Species	10	Section 6.2 and discussion below

Table 5-2 Summary of Other Matters Protected by the EPBC Act (10 km search radius).

Other Matters Protected by the EPBC Act	No.	Addressed in this EIS
Commonwealth Lands	None	NA
Commonwealth Heritage Places	None	NA
Listed Marine Species	7	Not applicable to site.
Whales and Other Cetaceans	None	NA
Critical Habitats	None	NA
Commonwealth Reserves	None	NA

Table 5-3 Summary Extra Information (10 km search radius).

Extra Information	No.	Addressed in this EIS
Place on the RNE	None	NA
State and Territory Reserves	None	NA
Regional Forest Agreements	None	NA
Invasive Species	6	Section 6.4
Nationally Important Wetlands	None	NA

With regard to the EPBC Act, three Commonwealth listed Endangered Ecological Communities were identified as having the potential to occur in the area:

- Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions.
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.
- Weeping Myall Woodlands.

None of these communities occur onsite nor would they be impacted by the construction or operation of proposed solar plant.

No Commonwealth listed threatened flora were returned from database searches, observed onsite or considered to have potential for impact.

Four threatened fauna were identified as having potential for impact, due to the presence of potential habitat onsite:

- Malleefowl (*Leipoa ocellata*)
- Superb Parrot (*Polytelis swainsonii*)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*)
- Koala (*Phascolarctos cinereus*)

Considering species listed as migratory, three were identified as having potential for impact:

- White-bellied Sea-eagle
- Rainbow Bee-eater
- Malleefowl

Considering the potential habitat available and the ecological characteristics of these species and the nature and extent of impacts proposed, none of these species were assessed has having greater than a low potential for impact as a consequence of the proposal.

Potential impacts to the above species are discussed in further detail in section 6.2 and within the Biodiversity Assessment, Appendix D.

A significant impact is considered highly unlikely and while a referral was submitted to DSEWPC to obtain certainty for the proponent, the proposed activity is considered highly unlikely to be a controlled action.

No other matter of national environmental significance would be affected by the proposed activity.

5.4.2 Native Title Act 1993

The *Native Title Act 1993* provides a legislative framework for the recognition and protection of common law native title rights. Native title is the recognition by Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. Where that traditional connection to land and waters has been maintained and where government acts have not removed it, the law recognises the persistence of native title.

People who hold native title have a right to continue to practise their law and customs over traditional lands and waters while respecting other Australian laws. This could include visiting to protect important places, making decisions about the future use of the land or waters, hunting, gathering and collecting bush medicines. Further, when a native title claimant application is registered by the National Native Title

Tribunal, the people seeking native title recognition gain a right to consult or negotiate with anyone who wants to undertake a project on the area claimed.

Native title may exist in areas such as:

- Vacant Crown land.
- Some national parks, forests and public reserves.
- Some types of pastoral lease.
- Some land held for Aboriginal communities.
- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A native title search was undertaken for the area potentially impacted by the proposed development in August 2010 to determine whether it may be affected by a native title determination, application or indigenous land use agreement (ILUA). The results showed that there is a Native Title Claimant in the project area, being the Barkandji Traditional Owners.

An updated native title search was undertaken in June 2012, which showed an application for native title on behalf of the Ngemba/Ngiyampaa People. It is noted that application excludes the land and waters covered by the Barkandji People's native title determination application NSD6084/1998 (Barkandji Traditional Owners #8 v Attorney General of NSW) (NC97/32).

All relevant land for the Nyngan Solar Plant was the subject of grants of freehold estate made before 23 December 1996, with the exception of the Crown Land parcel (Lot 7300, DP1156652). In AGL's view, in accordance with the *Native Title Act 1993*, these grants have extinguished any native title that existed in relation to these properties.

Native title may exist in relation to Lot 7300, DP1156652. AGL would undertake further historical tenure investigations in relation to this parcel of land to attempt to ascertain whether native title is likely to persist. To the extent that native title does exist in relation to the Nyngan Solar Plant site, AGL would comply with the provisions of the *Native Title Act 1993*.

5.4.3 Renewable Energy (Electricity) Act 2000

The *Renewable Energy (Electricity) Act 2000* (RE Act) aims:

- To encourage the additional generation of electricity from renewable sources.
- To reduce emissions of greenhouse gases in the electricity sector.
- To ensure that renewable energy sources are ecologically sustainable.

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth government's Renewable Energy Target (RET). This includes solar energy.

Certificates for the generation of electricity are issued using eligible renewable energy sources. This requires purchasers (called liable entities) to surrender a specified number of certificates for the electricity that they acquire. In January 2011, renewable energy certificates were reclassified as either large-scale generation certificates or a small-scale technology certificates following changes to the RET scheme.

5.5 OTHER RELEVANT POLICIES AND PLANS

5.5.1 Ecologically Sustainable Development (ESD)

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*.

In NSW, the concept has been incorporated in legislation such as the EP&A Act and Regulation. For the purposes of the EP&A Act and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline principles which can be used to achieve ESD. These principles are presented below along with a description of how the proposal and this EIS have considered each principle.

a) The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
   i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
   ii. an assessment of the risk-weighted consequences of various options.

The precautionary principle has been adopted in the assessment of impact; all potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been included to address the uncertainty.

b) Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The majority of potential impacts of the Nyngan Solar Plant are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Importantly, the proposal would address the need to minimise the risk of climate change to current and future generations by reducing carbon emissions.

c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.

The impacts of the proposal on biodiversity, including EPBC listed species, have been assessed in detail in the Biodiversity Assessment in Appendix D and are summarised in section 6.2.3. This has included avoidance of areas of higher conservation value and management prescriptions to minimise, manage and offset residual impacts.

d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:
   i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
   ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and

the ultimate disposal of any waste,

iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Attributes of the proposal site such as the existing native vegetation, soil and hydrology have been valued in terms of their broader contribution to the catchment and catchment processes.

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in section 8.2 provide an auditable environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the proposal at a local and broader level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of ESD.

5.5.2 Bogan Shire Council Management Plan 2009-2012

The Bogan Shire Council Management Plan includes Council's vision and mission statement, information on activities and performance objectives, and the revenue policy and Council's budget. The principal activities of Bogan Shire Council include administration, public order and safety, health, community services and education, housing and community amenities, water supply, sewerage services, recreation and culture, mining, manufacturing and construction, transport and communications and economic affairs. The proposal would impact on council water supply to a minor extent. Council would be consulted regarding access to water supply and expected volumes required.

5.5.3 Bogan Shire Council Community Plan

The Bogan Shire Council Community Plan has been developed to address legislative requirements of the *Local Government (General) Amendment (Community and Social Plan) Regulation 1998.* The Plan provides a basis for future decisions made by Council, the community and government agencies directed at improving the social and community opportunities within the Bogan LGA. The proposal would have a positive socio-economic impact in Bogan LGA by creating job opportunities for locals and utilising local services and industry. This is discussed further in section 7.4.

5.6 SUMMARY OF LICENSES AND APPROVALS

Table 5-4 Summary of licenses and approvals required.

Legal Instrument	License or Approval
EP&A Act, Part 4	• Development consent
Crown Lands Act, section 34	• Licence and easement in respect of Lot 7300 DP1156652.
Roads Act, section 138	• Approval to erect a structure or carry out a work in, on or over a public road.
EPBC Act	• Referral to DSEWPC to determine if the proposal constitutes a controlled action

Note, if it is determined that additional licenses or approvals are required, AGL would obtain these prior to commencement of relevant activities.

6 ENVIRONMENTAL IMPACT ASSESSMENT

6.1 INITIAL SCOPING AND RISK ASSESSMENT

A Scoping Study was undertaken, as part of the request for DGRs, to identify the key environmental issues associated with the project. The Scoping Study was based on a desktop review of available information.

After the site assessment, a risk assessment was undertaken to characterise the likely environmental risks associated with the construction, operation and decommissioning of the Nyngan Solar Plant. The aim of the risk assessment was to ensure that all relevant risks were investigated and mitigated as part of the project submission, relative to the degree of environmental risk they represent.

The risk rating is a factor of the **consequence** of an impact occurring and the **likelihood** of the impact occurring. Depending on the combination of consequence and likelihood, the overall risk rating could be low to extreme. High to extreme risks (termed 'key risks') have warranted a higher level of investigation. Risks identified as low or highly manageable are discussed in less detail.

Table 6-1 Risk assessment rating matrix.

Likelihood	Consequence				
	Negligible	**Minor**	**Moderate**	**Major**	**Catastrophic**
Remote	Low	Low	Low	Medium	Medium
Unlikely	Low	Low	Medium	High	High
Possible	Low	Medium	High	Very High	Very High
Likely	Medium	High	Very High	Very High	Extreme
Almost certain/ inevitable	Medium	High	Very High	Extreme	Extreme

Table 6-1 summarises the results of the risk assessment. Five key risks were investigated in detail in section 6, by way of specialist assessments:

- Biodiversity
- Aboriginal heritage
- Hydrology, including flooding
- Construction noise
- Visual amenity

Nine lower risk issues were investigated, primarily using desktop assessment, in section 7 of this EIS:

- Air quality
- Health and safety
- Land use
- Socioeconomic and community
- Traffic, transport and road safety

- Resource use and waste generation
- Fire and bush fire issues
- Historic heritage
- Soil and water, including water use

Cumulative impacts were discussed as the final section in section 7.

Table 6-2 Risk analysis of environmental issues.

Relevant EIS section	Environmental risk	Consequence	Likelihood	Risk rating
6.2	Biodiversity	Major	Possible	Very high
6.3	Aboriginal heritage	Major	Unlikely	High
6.4	Hydrology (surface and groundwater) and flooding	Moderate	Possible	High
6.5	Noise	Major	Unlikely	High
6.6	Visual amenity	Moderate	Possible	High
7.1	Air quality	Minor	Possible	Medium
7.10	Cumulative impacts	Minor	Possible	Medium
7.2	Health and safety	Moderate	Unlikely	Medium
7.3	Land use impacts (including mineral resources)	Minor	Possible	Medium
7.4	Socioeconomic and community wellbeing	Moderate	Unlikely	Medium
7.5	Traffic, transport and road safety	Moderate	Unlikely	Medium
7.6	Resource use and waste Management	Minor	Possible	Medium
7.7	Fire and bush fire	Minor	Remote	Low
7.8	Historic heritage	Minor	Unlikely	Low
7.9	Soil and water (includes water use)	Minor	Unlikely	Low

6.2 BIODIVERSITY (FLORA AND FAUNA)

The loss and modification of native vegetation and habitat can present serious risks to the persistence of native flora and fauna. A Biodiversity Assessment was undertaken to investigate these issues (provided in full in Appendix D). The assessment was undertaken with reference to Commonwealth, NSW and local guidelines, including specific comments from the Central West CMA and OEH (refer Table 4-1). This section summarises the key findings of the Biodiversity Assessment, undertaken by **ngh**environmental.

6.2.1 Approach

The Biodiversity Assessment was completed with reference to:

- Threatened Species Assessment Guidelines (DECC, 2007)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004)
- Central West Catchment Action Plan 2006-2016
- Central West Catchment Action Plan 2011-2021

The general approach included:

- A desktop review of research literature, online databases and other sources to determine regional and local biodiversity values and assist field survey planning and design.
- Field flora and fauna surveys and habitat assessments, including follow-up targeted survey to investigate potential impacts to Grey-crowned Babbler populations. Specifically:
    - Flora surveys 16-18 May and 1 June 2012 totalling 33 person hours of survey: random meanders, inspections and targeted searches, understorey condition assessments
    - Fauna surveys 3-4 May, 16-18 May, 1 June and 20-23 August 2012 totalling 46 person hours of survey: Habitat assessment, microbat survey, anabat analysis, nocturnal call playback, nocturnal spotlighting, opportunistic records, targets surveys
- Analysis and assessment of data to establish the conservation values and significance of proposed impacts in relation to relevant environmental legislation.
- Development of measures to reduce the risks and identified impacts, focussing on avoidance and mitigation and offsets where avoidance is not feasible.

A preliminary constraints report was provided to AGL early in the proposal planning phase, after the completion of desktop review and field surveys. Based on the biodiversity constraints identified, the proposal was modified with the aim of avoiding areas of high biodiversity value and therefore minimising impacts to biodiversity. The Biodiversity Assessment assessed the revised layout.

6.2.2 Results

Site context

The site is within the Central West Catchment Management Authority (CMA) and falls into the Cobar Peneplain Bioregion and the Canbelego Downs IBRA subregion. The characteristic landforms of this subregion include floodplains and channels of the Bogan and Macquarie Rivers.

The site consists of flat terrain, characteristic of the alluvial floodplains of the Nyngan locality. The solar plant site is largely cleared with linear patches of remnant native vegetation and scattered trees. It has been highly modified by past agricultural activities including clearing, cultivation and grazing.

The disturbance at the site has led to the colonisation of a range of introduced plant species. Minor pasture weed species were common across the majority of the study area. Two noxious weeds declared for the Bogan Shire Council Area under the *Noxious Weeds Act 1993*, Bathurst Burr (**Xanthium spinosum*) and Hunter Burr (**Xanthium italicum*), were recorded at the subject site. These weeds are listed as Class 4 noxious weeds.

Vegetation types

Native vegetation within and surrounding the study area consists of, or is derived from, a single vegetation type: Poplar Box - Gum-barked Coolabah - White Cypress Pine shrubby woodland. This vegetation community is not listed as threatened under State or Commonwealth legislation. All the native vegetation at the site would be considered to be in moderate to good condition (under the NSW Biobanking assessment methodology).

Habitat types

Generally the fauna habitat quality was higher in the southern portion of the study area (south of the Barrier Highway, where the transmission easement is located) where patches of open woodland with some connectivity exist. North of the Barrier Highway, the site is more degraded. The majority of habitat available for fauna across the study area occurs along the fringes of the site in these corridors and in patches to the south of the Barrier Highway. These areas contain an abundance of leaf litter, dead wood, and hollow-bearing trees. Nests, consisting of grass, sticks or mud, were abundant in the roadside corridors in both trees and large shrubs. One dam occurs on site. It provides poor habitat due to stock access.

Threatened species

No threatened flora species were detected during the surveys. Based on the results of the desktop assessment, two NSW threatened flora species have the potential to occur at the site: the Red Darling Pea and Pine Donkey Orchid. Pre-construction surveys will be conducted for the Red Darling Pea and Pine Donkey Orchid.

A total of five threatened fauna species were identified during field surveys: Superb Parrot, Grey-crowned Babbler, Yellow-bellied Sheathtail Bat, Little Pied Bat and Inland Forest Bat. Based on the results of the desktop assessment, a number of additional threatened fauna species have the potential to occur at the site; all threatened species with potential to occur were evaluated in terms of potential to be impacted by the development. Five fauna species were considered to have greater than low potential to be impacted by the proposal: Turquoise Parrot, Grey-crowned Babbler, Little Pied Bat, Yellow-bellied Sheathtail-bat and Inland Forest Bat.

6.2.3 Potential impacts

Construction and decommissioning

Clearing would be required to develop the solar plant. The plant would occupy a total footprint of approximately 300 hectares, approximately 2% of which is native Poplar Box Woodland vegetation. Most of this area however would not be directly impacted; because the solar modules would be mounted above the ground, the area beneath them would be shaded rather than cleared. Therefore, habitat under the modules would be modified rather than removed.

The transmission easement would occupy a total footprint of approximately 14 hectares of which approximately 30% is native Poplar Box Woodland vegetation. Trees would be removed to establish a clear zone within the easement but shrubs and grasses would be retained.

There is a risk of noxious and environmental weed introduction and spread through activities that disturb the soil. Weed management will be required.

Clearing would remove habitat features including tree food sources, nest sites, tree hollows, and rock habitats, and would affect habitat connectivity and nest sites. While the development of the solar plant would remove up to 10 hollow bearing trees (6 on the solar plant site and 4 on the transmission easement) and may reduce foraging habitat for some species, there is an abundance of hollow bearing trees and open pasture habitats in the surrounding locality and the loss of up to ten is not considered likely to generate a significant impact for any hollow-dependent fauna. Removal of hollow-bearing trees is however a Key Threatening Process under the TSC Act and offsetting hollows would be undertaken as part of the proposal. Additional risks to fauna include potential entrapment during trenching, disturbance from noise, light and vibration and potential for vehicle collision risks.

Habitat for several threatened fauna species is present at the site. The Grey-crowned Babbler would be impacted by the proposal due to loss of breeding and foraging habitat. During the May/June surveys, a total of 5 nest sites and 5 family groups were recorded within the solar plant site. In the vicinity of the transmission line easement, a total of 1 nest site and 1 family group were recorded. During the targeted surveys in August a total of 54 nest sites and 23 family groups were recorded both on and off site.

Based on population viability analysis in Victoria, a viable population is likely to contain more than 10 family groups, while populations with less than 10 groups are likely to have a high rate of extinction (Parsons Brinkerhoff 2005). According to the surveys conducted in August, approximately 16-17 family groups occur on site and in woodland corridors immediately adjacent to the site. Multiple observations of a family group of 6 individuals within Area 3, and 3 nest sites, indicate that this one family group would be impacted by the proposal. A Seven Part Test was prepared for the Grey-crowned Babbler and concluded a significant impact for this species is not considered likely. However, precautionary measures have been included as mitigation measures to minimise and offset impacts to this species.

A conservative approach has been taken and it is assumed the hollows to be removed may also provide habitat for the Pink Cockatoo and Squirrel Glider, though the presence of these species has not been confirmed over the course of several surveys. Specific mitigation measures have been formulated to address risks to these and other hollow-dependent fauna.

Construction impacts are not considered likely to be significant in view of the condition of the vegetation, the low conservation and habitat values and the local abundance of similar vegetation and habitat in the locality.

Operation

Operational biodiversity impacts could include microclimate impacts under the PV array (shading, temperature, humidity), weed growth and spread, loss of or alteration to grassland habitat for macropods, birds, reptiles and insects due to shading, changed microclimate and reduced productivity. There is potential for perimeter fencing and the electricity easement to present a movement barrier and for fencing and power lines to be a collision hazard for fauna. There is potential for avoidance of habitat and vehicle collision risks.

The operational phase of the project would require careful management of pasture under the PV array to control weeds and maintain good groundcover resistant to erosion. This is considered to be readily achievable and mitigation measures have been included to address this.

6.2.4 Mitigation

By identifying areas of high biodiversity values early in the planning process via a constraints analysis and then using this information to develop a sensitive layout design, the proposal achieves the aim of avoiding key habitat elements.

The mitigation measures developed set out required actions to minimise and offset residual impacts to biodiversity. Further flora surveys for the Red Darling Pea and Pine Donkey Orchid would be undertaken to assist micrositing and offsetting, if required. Pre-clearance surveys would be conducted prior to felling hollow-bearing trees.

Management plans would include a groundcover management plan to ensure ground cover is retained under the panels. Areas of native vegetation that were impacted by the proposal would be rehabilitated to a level that demonstrates an increase in the environmental values of the site compared to its pre operational state: A rehabilitation plan would be prepared that includes ongoing monitoring to ensure the rehabilitation is successful for the long-term. Furthermore, an Offset Strategy outline has been prepared (within the Biodiversity Assessment) to provide certainty around:

- How offsets will be identified
- How offsets will be managed
- How offsets will be secured
- How OEH's *Principles for the use of Biodiversity Offsets in NSW* are addressed

An Offset Plan would be prepared in accordance with the offset strategy outline and finalised prior to construction. The proponent would prepare an offset plan before construction but would ensure that the actual areas impacted are validated after construction to ensure that the actual impacts have been offset. Validation of the impact area post construction is not intended to delay specifying the offset site pre-construction, but is intended to provide certainty that the actual area of impact has been offset. Further it provides an incentive during construction to minimise the footprint and thereby impact less habitat and reduce the project's offset requirement.

The objective of offsetting is to ensure that an overall 'maintain or improve' outcome is met for the project; where impacts cannot be avoided, or sufficiently minimised, the residual impact would be offset in perpetuity. Monitoring of offset site management actions would be undertaken and reported during the operational life of the project.

With the effective implementation of these measures, the proposal is able to meet the objective to 'maintain or improve biodiversity values'. Referral is not considered to be required for any NSW or Commonwealth listed threatened entity.

Further information about biodiversity measures is provided in section 8.2.

6.3 ABORIGINAL HERITAGE

Development can impact on Aboriginal heritage, through direct physical damage to sites as well as indirect impacts on places of significance. OEH indentified issues relating to Aboriginal Cultural Heritage as important during development of the DGRs for this proposal (refer Table 4-1). Specific OEH issues are addressed in this section.

This section contains excerpts from and outlines the key findings of the Aboriginal Cultural Heritage Assessment, undertaken by New South Wales Archaeology Pty Limited. The Aboriginal Cultural Heritage Assessment report is provided in full in Appendix D.

6.3.1 Approach

The Aboriginal Cultural Heritage Assessment (ACHA) has sought to identify and record any Aboriginal cultural areas, objects or places, to assess the archaeological potential of the proposal areas, and to formulate management recommendations based on the results of the community consultation, background research, field survey and a significance assessment.

The ACHA has been conducted in accordance with the Draft Guidelines for *Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005), the NSW Office of Environment and Heritage *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010a).

Aboriginal community consultation has been undertaken as part of the ACHA and has been conducted in accordance with the guidelines set in the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005) and OEH's *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010b).

The ACHA (see Appendix D) includes the following:

- Description of the land and history of peoples living on the land.
- A review of previous archaeological work and heritage listings on the NSW DECCW Aboriginal Heritage Information Management System.
- A predictive model of Aboriginal object type and location relevant to the proposal site.
- Methodology implemented during the field inspection.
- Results of the field inspection.
- The Aboriginal consultation process.
- A description of the impact history of the proposed site.
- An assessment of the impact of the proposal on Aboriginal objects and places.
- Consideration of management and mitigation measures.

6.3.2 Results

The study area is located within the Murray Darling Basin, one of Australia's largest drainage divisions. The basin includes the three largest rivers in Australia: the Murray River, the Darling River and the Murrumbidgee River. Aboriginal people have occupied the region for over 40,000 years, with early occupation focussed on the resources of freshwater lakes and rivers and their floodplains. This occupation also occurred along various river channels that pre-date the present Murray-Darling River system (Murray-Darling Basin Ministerial Council 1987: 353). Archaeological evidence indicates that with

the drying up of the lakes around 26,000 years before present (BP) in response to changes in climatic conditions, Aboriginal people remained near major rivers. However, by 4000 years BP there is evidence of a major increase in site numbers and more intensive occupation to what are today more marginal environments (MDBMC 1987:354).

According to Tindale (1974) the study area is situated within the Wongaibon territory which included the headwaters of the Bogan River encompassing present day Nyngan. The area is located within the Nyngan Local Aboriginal Land Council boundaries. It is also within the area subject to a Native Title Claim (NNTT number: NC12/1) by the Ngemba/Ngiyampaa People.

In an Aboriginal landuse context the area is likely to have been utilised by Aboriginal people for an extremely limited range of activities which may have included hunting and gathering, resource gathering and travel through country. Such activities are likely to have resulted in very low levels of artefact discard. The nature of stone artefacts discarded can be expected to have been correspondingly limited in terms of artefact diversity and complexity.

A search of the NSW OEH Aboriginal Heritage Management Information System (AHIMS) has been conducted for this project on the 14 June 2012 (Client Service ID: 72500). The search area measured 56 km² and encompassed eastings 504000 – 511000, and northings 6503000 –6512000.

No Aboriginal objects are recorded on AHIMS as being present within the site search area (see Appendix 1 of the ACHA report). However, the AHIMS register only includes sites which have been reported to NSW OEH. Generally, sites are only recorded during targeted surveys undertaken in either development or research contexts. Accordingly, this search cannot be considered to be an actual or exhaustive inventory of Aboriginal objects situated within the local area or indeed within the study area itself.

The most common Aboriginal object recordings in the region are distributions of stone artefacts and scarred trees. In and around Nyngan, scarred tree recordings are the most common site type, although whether or not their attributed artefactual status is correct is equivocal. Rare site types include rock shelters, quarry and procurement sites, burials, stone arrangements, carved trees and traditional story or other ceremonial places. The distribution of each site type is related at least in part to variance in topography, ground surface geology and water.

A predictive model of Aboriginal Site Distribution has been constructed for the purpose of ACHA based on a review of previous archaeological work and consideration of the topography, geomorphology and hydrology of the study area. The type of sites known to occur in the region and the potential for their presence within the area included in Table 6-3.

Table 6-3 Predicted Aboriginal sites and potential presence.

Type of Aboriginal site	Potential presence
Stone artefacts	Negligible or very low density
Hearths	Low potential
Grinding grooves	Unlikely
Burial sites	Low potential
Rock shelter sites	Unlikely
Scarred and carved trees	Some potential
Stone quarry and procurement sites	Unlikely
Ceremonial grounds	Unlikely

Previous farming practices have caused reasonably high levels of impact to ground surfaces and to any Aboriginal objects which may once have been present.

All trees located within areas of direct impact were inspected during the survey and no evidence of Aboriginal scarring is evident. Three trees with notable scars were found, assessed and determined to be unlikely to be Aboriginal in origin.

At the time of field survey, two paddocks were under cultivation while two others were fallow (old Lucerne paddocks). A comprehensive and systematic pedestrian survey was undertaken in the two cultivated paddocks, while a vehicle traverse was conducted across the fallow paddocks. The entire length of the proposed transmission line was walked.

The Aboriginal heritage study area measured approximately 437 hectares in size. It was estimated that approximately 203 hectares of that area was subject to physical survey inspection. Ground exposures included bare earth, erosion scalds, animal tracks and roads. Of that ground exposure area archaeological visibility (the potential artefact bearing soil profile) was estimated to have been 182.4 hectares. Effective Survey Coverage was therefore calculated to have been 33.1% of the proposal area.

Three Aboriginal object locales were recorded during the field survey, and each comprised a single stone artefact. This is a relatively small number of artefacts and the survey results are considered to be a reliable indicator of the low archaeological status and potential of the area. The identified artefacts are assessed to be of low cultural and archaeological significance. Undetected or subsurface stone artefacts are predicted to be present in extremely low density.

Aboriginal community consultation

In order to identify, notify and register Aboriginal people who may hold cultural knowledge relevant to determining the cultural significant of Aboriginal objects and/or places in the area of the proposed project, an advertisement was placed in the local newspaper (20 June 2012) and correspondence was sent (12 June 2012) to the below organisations/persons inviting parties to register their interest in the proposal.

- OEH Dubbo office.
- Nyngan Local Aboriginal Land Council.
- the Registrar, *Aboriginal Land Rights Act 1983*.
- the National Native Title Tribunal, requesting a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements.
- Native Title Services Corporation Limited (NTSCORP Limited).
- Bogan Shire Council.
- the Central West Catchment Management Authority, requesting contact details for any established Aboriginal reference group.
- Mr John Shipp.
- Bogan Aboriginal Corporation.
- Native Title Claimants (Native Title Claim NC12/01).

The registered Aboriginal parties for this project were:

- The Nyngan Local Aboriginal Land Council.
- Bogan Aboriginal Corporation.
- Mr John Shipp.

Representatives of the Nyngan LALC and the Bogan Aboriginal Corporation participated in field investigations.

No comments were received during the 28 day period for review of the draft ACHA report.

6.3.3 Potential impacts

Construction and decommissioning

Construction of the solar plant, namely any works involving ground disturbance, has the potential to cause impacts to any Aboriginal areas, places or objects which may be present within the zones of direct impact. European-activated geomorphological processes and other natural processes associated with land degradation, would have caused significant prior impacts to Aboriginal objects within the proposal area. It is considered that regardless of any prior impacts, the project has the potential to cause additional impacts to any objects which may be present within the subject area.

The Aboriginal object locales recorded in the proposal area (and any undetected and subsurface artefacts) do not surpass archaeological and cultural significance thresholds which would act to preclude the construction of the proposed solar plant.

The field survey undertaken as part of this assessment focused on recording artefactual material present on visible ground surfaces.

Consideration of management and mitigation strategies has been undertaken as part of the ACHA.

Further archaeological investigation could entail subsurface excavation in the form of test pits for the purposes of identifying the presence of artefact bearing soil deposits and their nature, extent, integrity and significance. Based on consideration of the predictive model of site type and the subject land condition (i.e. highly disturbed from cultivation) further investigations are not considered to be necessary or warranted.

Conservation is considered a management option in any situation, though it is not always feasible. In this case, avoidance of impacts or minimisation of impacts in relation to the recorded artefacts locales is not considered to be warranted.

Mitigated impact usually takes the form of partial impacts only (i.e. conservation of part of an Aboriginal artefact locale or Survey Unit) and/or salvage in the form of further research and archaeological analysis prior to impacts. The archaeological resource in the proposal area does not surpass significance thresholds which warrant any form of impact mitigation. Given the nature and artefact density in the proposal area, and the low scientific significance rating they been accorded, unmitigated impacts are considered appropriate. A strategy of impact avoidance is not warranted in regard to these locales.

Operation

It is considered unlikely that any impacts to Aboriginal sites would occur during the operation of the solar plant and associated transmission line. Therefore no additional mitigation measures are considered necessary.

6.3.4 Mitigation

Avoidance or impact mitigation strategies are not considered necessary for the proposed project.

Further information about Aboriginal heritage measures is provided in section 8.2.

6.4 HYDROLOGY (SURFACE AND GROUNDWATER)

The NSW Government's *Floodplain Development Manual* was developed to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property (DIPNR 2005). While local councils are generally responsible for local planning including floodplain risk management, for proposals assessed under Part 4 of the EP&A Act, the impacts are considered by the state government.

An investigation of surface hydrology at the site was undertaken by SKM in March 2011 (provided in Appendix D and summarised below). Consistent with the Floodplain Development Manual, the report assesses the risk of flooding. The EPA indentified issues relating to surface hydrology as important during development of the DGRs for this proposal (refer Table 4-1). Surface hydrology issues raised by the EPA are addressed in this section.

Soil erosion and water quality are addressed in section 7.9.

6.4.1 Background

Surface hydrology

Flooding

The proposal area is located 8 kilometres west of the Bogan River and lies on the floodplain of Whitbarrow Creek, a tributary of the Bogan River. Whitbarrow Creek divides into two main branches – the northern flowpath and eastern flowpath. The northern flowpath is considered the main carrier for Whitbarrow Creek flows. Whitbarrow Creek (northern flowpath) flows in a north-easterly direction across the proposed power easement, approximately 800 metres south of the solar plant site. It is intermittent and lacks definition in several areas. The Bogan River and its tributaries, including Whitbarrow Creek, are shown on Figure 6-1.

Approximately 6 kilometres downstream of the main channel split, the northern flowpath of Whitbarrow Creek passes under the Nyngan-Cobar Railway line through seven 1.5 metre diameter Armco pipes and a set of flood relief pipes located 650 metres east of the creek. The Armco pipes are located approximately 1.6 kilometres south of the Nyngan property.

Downstream of the railway, the creek passes under the Barrier Highway through six 2 metre x 1 metre box culverts (size estimated). The highway formation is lower than the railway embankment. As the railway line is elevated above ground level (2.6 metres at the main culverts and 1.6 metres at the flood relief culverts), water can pond against the upstream side of the railway and flow both to the north through the railway formation and east towards the Bogan River. For large events, the railway would potentially be overtopped and flood waters would continue downstream towards the Bogan River. Water levels higher than the railway level are expected to result in wide shallow flow over the railway formation.

Land within the proposed transmission line easement, south of the Barrier Highway, has experienced impacts from flooding twice in the last 50 years (1980 and 1992). The 1990 Nyngan floods did not significantly affect the Whitbarrow Creek Catchment and therefore this land was not inundated during this event.

Land within the proposed transmission line easement, north of the Barrier Highway, and the solar plant site has not been subjected to prolonged substantial inundation from Whitbarrow Creek overflow. No gully or flow erosion features are present on the site indicating slow moving sheet flow. Runoff through

and from the solar plant site is directed mainly in an easterly and north-easterly direction towards the Mitchell Highway. Runoff on the site ultimately drains to the Bogan River.

Drainage

No defined floodways have been identified within the property, suggesting that local drainage is mainly sheet flow following the gentle grade from south-west to north-east. Sheet flow is initiated when the soil profile is saturated, when rainfall intensities exceed soil infiltration rates or when flows from external catchments flow onto the property.

The north-eastern corner, which has the lowest elevation, appears to be the outlet to any water draining through the property. The local catchment of the property is approximately 8 square kilometres and drains east-north-east towards the Mitchell Highway.

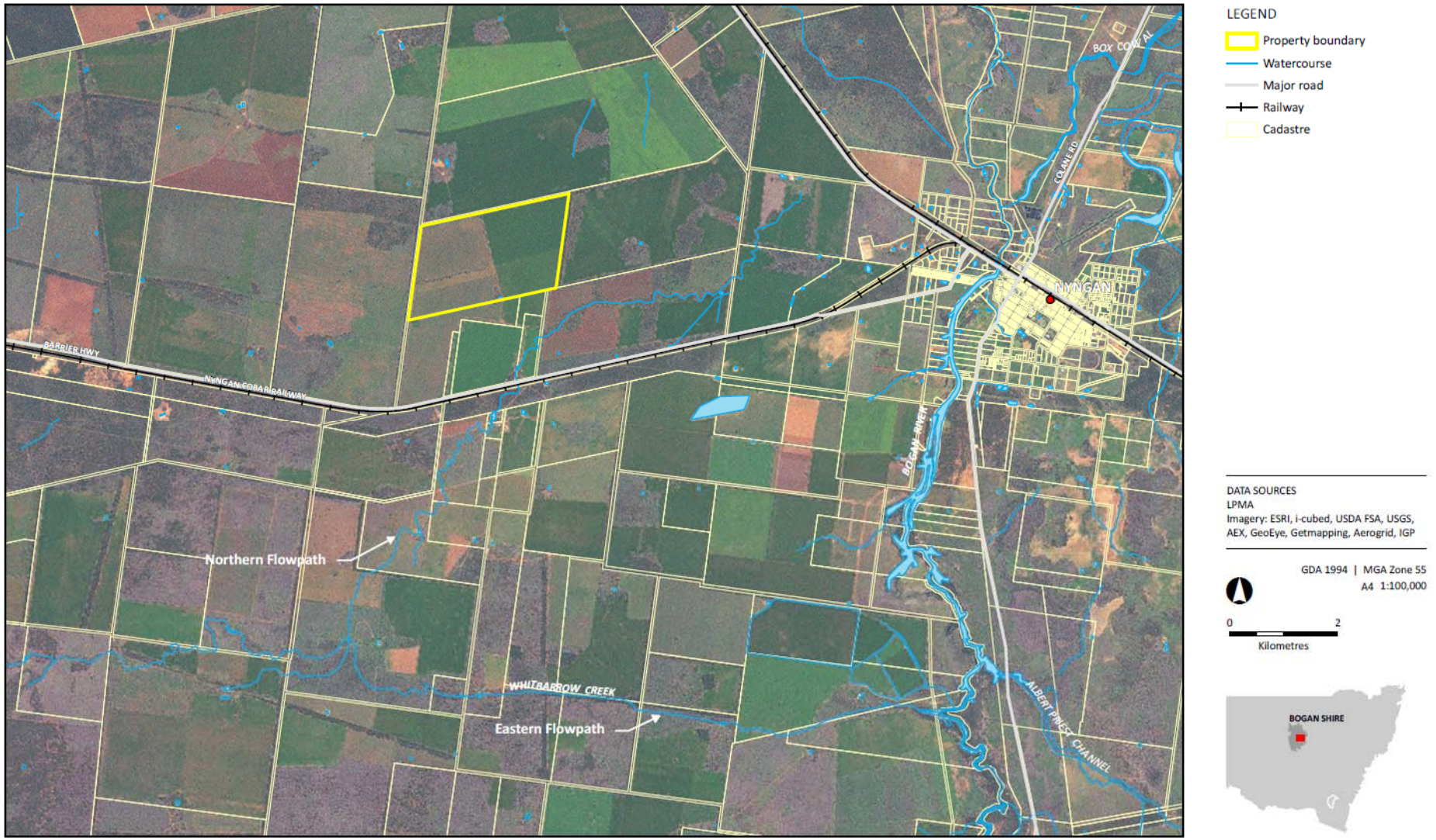


Figure 6-1 Watercourses in the Nyngan locality.

(Source: SKM 2011)

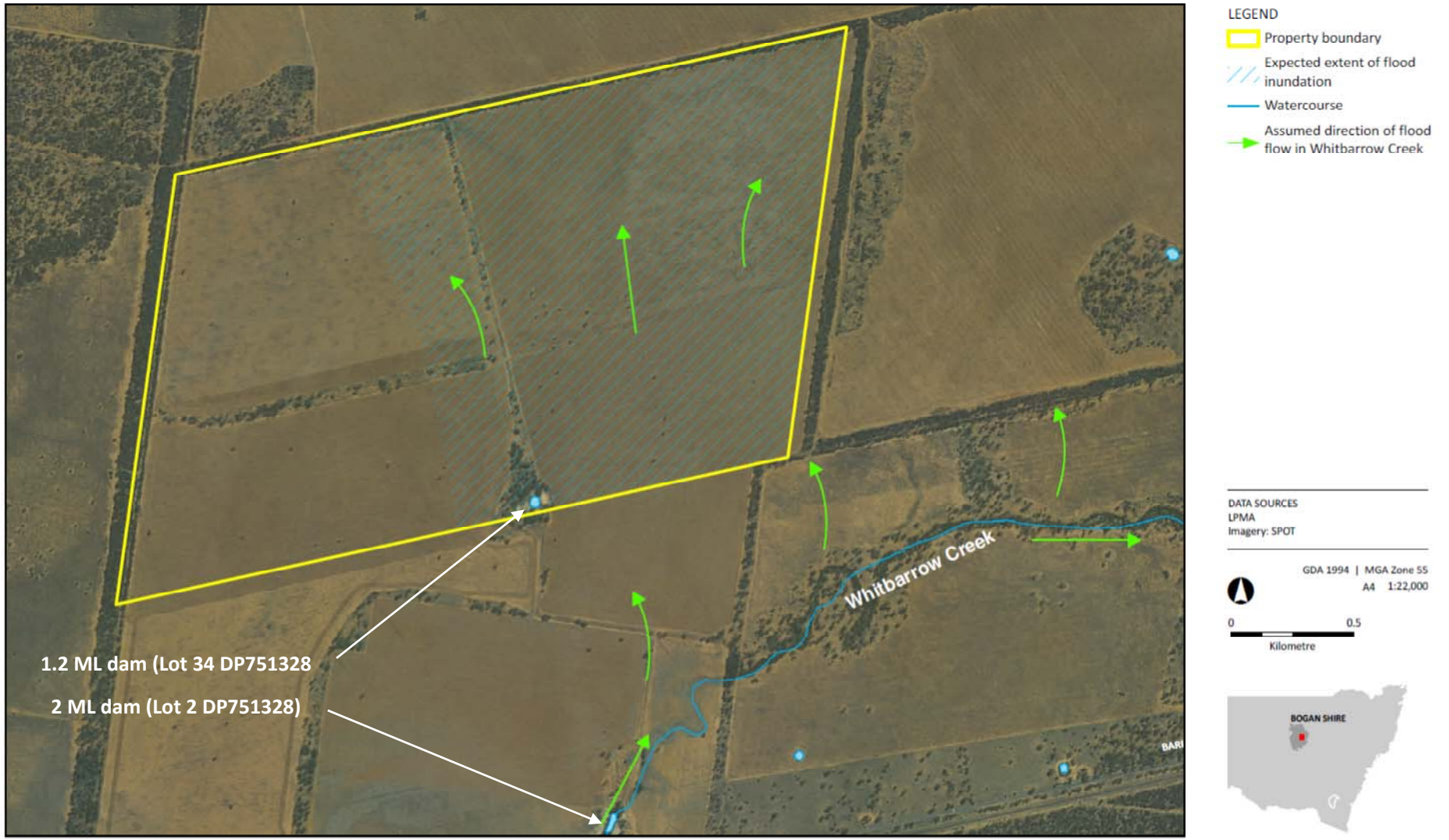


Figure 6-2 Inundation zones at the solar plant site.

(Source: SKM 2011)

Groundwater

There are no groundwater bores within the proposal area. However, there are several within the Nyngan locality. The proposal area is located on land with saline groundwater (NSW Government 2012c). The NSW Natural Resource Atlas mapping shows bores located in proximity to the site (Figure 6-3). Data for the four closest bores to the north, south-west, east and west indicates a variation in depth to the water bearing zone from 30 to 60 metres (i.e. 40 metres, 33.5 metres, 30.5 metres and 60 metres respectively).

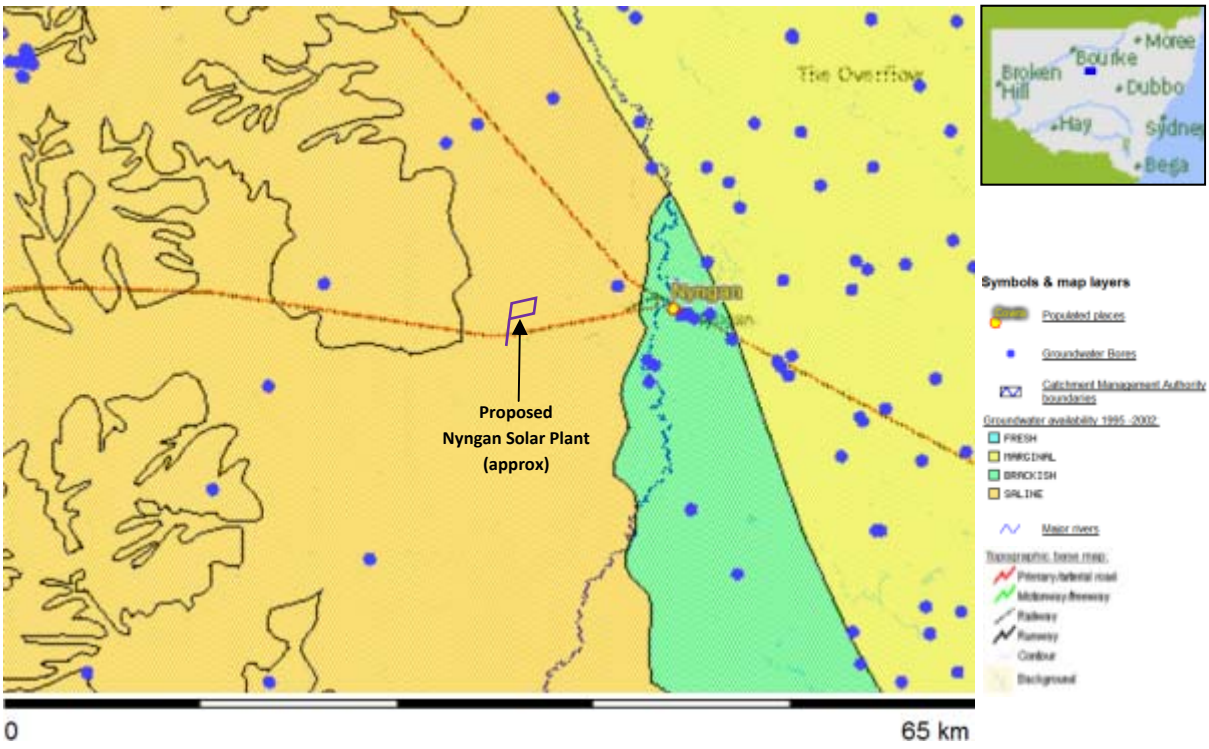


Figure 6-3 Groundwater boreholes at Nyngan and groundwater availability.

Map created with the NSW Natural Resource Atlas – www.nratlas.nsw.gov.au 8 August 2012. Copyright © 2012 New South Wales Government. Map has been compiled from various sources and may contain errors or omissions. No representation is made as to its accuracy or suitability.

6.4.2 Potential impacts

Construction and operation

Surface hydrology

The solar plant site can potentially be subject to inundation during overflows from Whitbarrow Creek, particularly in the eastern areas. During a 100 year Average Recurrence Interval (ARI) event, the flow in Whitbarrow Creek floodplain is constrained on its southern bank by the railway line. However, from the available topographic and flood modelling data, it is considered that the creek would break its northern bank approximately 1 kilometre downstream of the railway line. The breakout flow would likely move overland towards the north-east and through the property. It is estimated that approximately 100 m^3/s would be conveyed through the property in a 100 year ARI event. Based on the relatively flat terrain and the absence of gullies (erosion due to fast concentrated flows), it is considered that the water would move as shallow sheet flow along the eastern part of the property. Based on hydraulic calculations, flood

depths and velocities within the property are estimated at 0.3 m/s and 0.2 m/s, respectively. The shallow sheet flow would cover approximately 60% of the property. Hence, the property would not be subject to flooding from Whitbarrow Creek above a depth of 0.3 metres in a 100 year ARI event.

The impact of localised drainage on the property in a 100 year ARI event is considered minor. Preliminary hydraulic assessment indicates that the property would experience only marginal flooding from local catchment drainage. It is expected that most areas within the Nyngan property would experience shallow sheet flow up to a maximum depth of 0.25 metres in an estimated 100 year ARI event. The velocity of flow through the property is expected to be slow due to the flat nature of the terrain.

Equipment that is situated below 0.3 metres above ground level may be affected during flooding events. The PV plant construction would involve PV modules mounted above the ground on posts that are pile driven to the ground. Flows past array posts may generate localised turbulence and soil erosion, although in view of the low flow velocity and retained vegetation cover, these impacts are expected to be minor. Access roads and transmission lines would not be affected. The substation and office building would be designed to accommodate a 1:100 year flood and be located in the south-west corner of the site, outside the inundation zone.

Groundwater

Considering the depth of local groundwater (30-60 metres), local groundwater resources would not be affected by the physical impacts of construction. Similarity, contamination of groundwater would be highly unlikely given that chemicals and fuels would be appropriately stored, and spills procedures would be implemented (spill management is discussed in section 7.9). Long-term storage of large volumes of chemicals or fuels is not proposed.

Clearing of trees can impact on groundwater; saline groundwater can move up through the soil profile if there is a reduction in water uptake and transpiration by trees in the landscape, exacerbating salinity impacts. The clearing proposed during construction is minor in this context and would be offset (refer to section 6.2 for clearing, offsetting and site rehabilitation commitments). No operational impacts would affect groundwater at the site.

Water use is addressed in section 7.9, however it is noted that no water is proposed to be sourced from groundwater supplies.

As the Proposal would not be altering the existing groundwater supplies within the solar plant site, it is considered that no impacts to Groundwater Dependent Ecosystems (GDE) would result from the Proposal. Additionally, it is noted that there are no High Priority GDEs as listed on Schedule 4 of the *Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008* regulation in proximity to the proposal site. The closest such GDE is over 80km to the north of the site.

Decommissioning

All areas of soil disturbed during decommissioning would be rehabilitated; all aboveground infrastructure would be removed from the site and groundcover vegetation restored. No additional impacts from the decommissioning of the project are anticipated.

6.4.3 Mitigation

Hydrological impacts have primarily been dealt with as part of the design of the project. A specific surface hydrology mitigation measure to ensure this is achieved is provided in section 8.2.

6.5 NOISE IMPACTS

Construction noise at low levels can be a nuisance and at high levels a health risk for nearby receivers. Construction noise impacts were investigated using background noise loggers and modelling based on the type of equipment that would be used. The investigation results are summarised in the section below and provided in full in Appendix D. The EPA indentified issues relating to noise as important during development of the DGRs for this proposal (refer Table 4-1). Specific issues raised by the EPA are addressed in this section. Furthermore, the assessment was peer reviewed by SLR Consulting in December 2012 and has been updated to include this additional assessment.

Vibration and operational noise from transmission lines and the substation are also discussed in this section. Traffic noise is considered separately in section 7.5.

6.5.1 Background

The proposal area is located in a rural environment close to the Barrier Highway. The existing noise environment would include intermittent noise from a variety of sources, predominantly farm vehicles and machinery, animals, and traffic noise from the Barrier Highway (particularly trucks). Additionally, the Western rail line – Cobar branch runs parallel with the Barrier Highway past the subject site.

Sensitive receivers

The locations of potential sensitive receivers with respect to noise from the project are illustrated on Figure 6-4. There are few noise-sensitive receivers within the vicinity of the proposal site. The closest residence (shown at noise log 1) is that of a landholder involved in the Nyngan Solar Plant proposal and as such potential noise impacts are not considered for this residence[1]. The closest non-involved landholder residences include two residences mapped by the Department of Lands (2012) north and south of noise log 3 (although only the northern property was verified to be occupied during the site inspection) and the residence shown at noise log 2.

Several other residences are located within 10 kilometres of the works, but are further than 3.5 kilometres from the closest boundary of proposed works. Given the distance to works and the presence of intervening vegetation, they are considered unlikely to be impacted by noise.

[1] The purpose of this EIS is to consider impacts of the proposal on the environment and broader community external to the proposal. As this landholder is involved in the project, potential impacts to them are addressed through other agreements and internal avenues.

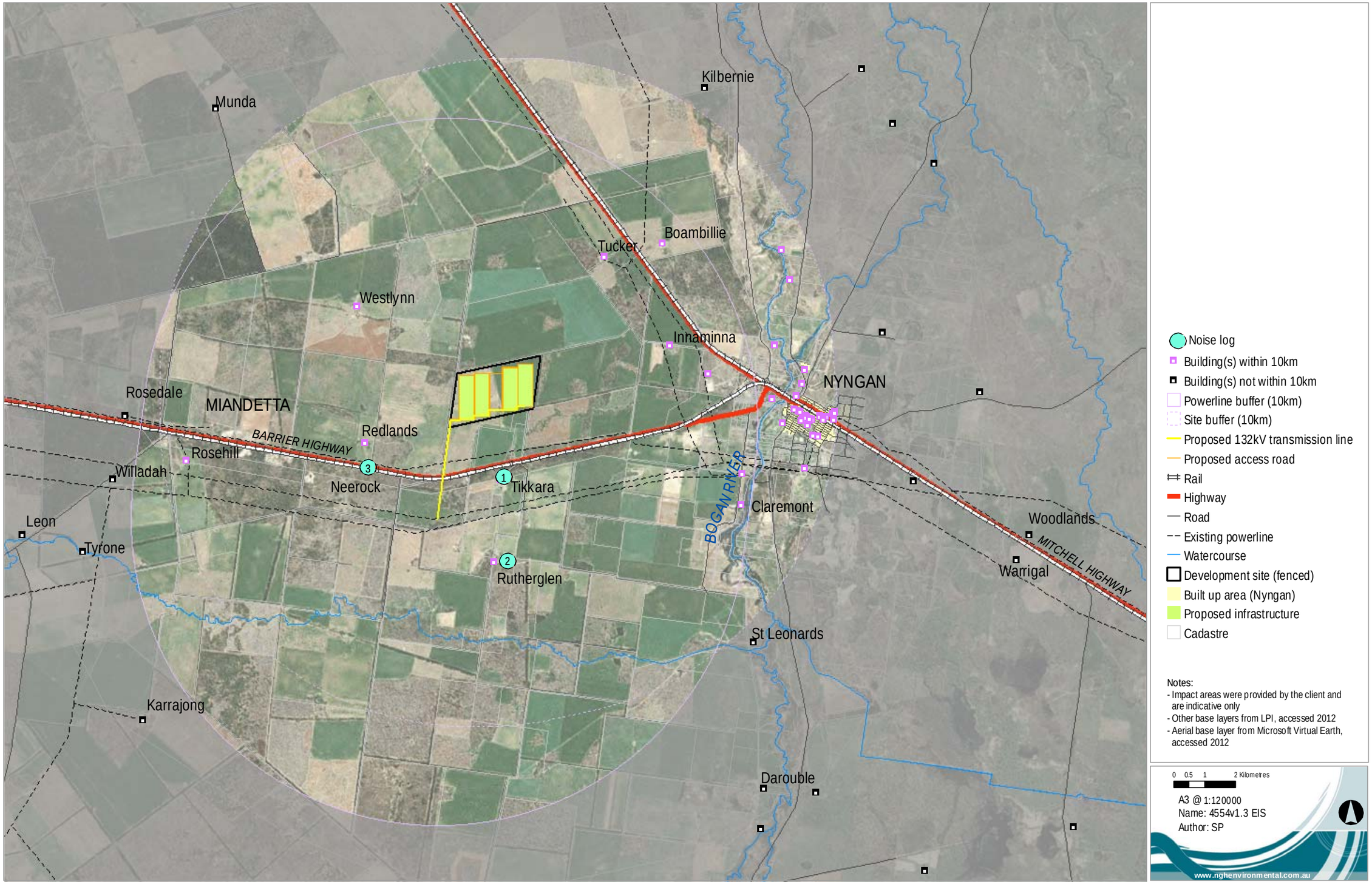


Figure 6-4 Sensitive noise receivers.

Assessment policies and guidelines

Construction noise

The *Interim Construction Noise Guideline* (DECC 2009) sets out construction noise management levels at sensitive receivers and how they are to be applied. This approach intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

Background noise readings were undertaken at the four closest sensitive receivers (noise log site 3 related to two potential residences, however one was later discounted as a sensitive receiver as no buildings were present). Background noise levels at each location are provided in Table 6-4. This table also provides the 'allowable noise level' and 'highly affected noise level' in accordance with criteria set in the *NSW Interim Construction Noise Guideline*.

Table 6-4 Background noise levels and allowable noise levels at the closest sensitive receivers.

Sensitive receiver[2]	Rating background level during standard working hours (L_{A90} (15 minutes))	Allowable noise level during standard working (RBA + 10 dB)	Highly affected noise level
Residence 1 – located at noise log 1 (involved landholder)	*32.4 dBA*	*42.4 dBA*	*75 dBA*
Residence 2 – located at noise log 2	34.9 dBA	44.9 dBA	75 dBA
Residence 3 – located north of noise log 3	33.7 dBA	43.7 dBA	75 dBA

Operational noise

The *NSW Industrial Noise Policy* (EPA 2000) specifies noise criteria to protect the community from excessive intrusive noise. According to this policy, noise levels within a rural residential area from industrial noise sources should not normally exceed the acceptable levels specified below.

Table 6-5 NSW Industrial Noise Policy amenity goals.

Receiver type	Indicative Noise amenity area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

[2] Residence 4, referred to in the Noise Assessment (refer Appendix D), has now been verified as having no buildings present and is therefore no longer considered a sensitive receiver in the EIS.

Vibration

The DECC (2006) guideline *Assessing Vibration – A Technical Guideline* identifies levels that may cause disturbance to humans from exposure to vibration from industry, transportation and machinery.

Table 6-6 Vibration criteria.

Place	Time	Assessment criteria					
		rms velocity (mm/s) Peak particle velocity (mm/s)		Vibration velocity value (dB re 10^{-6} mm/s)[3]		Vibration dose values for intermittent vibration ($m/s^{1.75}$)	
		Preferred	**Maximum**	**Preferred**	**Maximum**	**Preferred**	**Maximum**
Continuous vibration							
Residences	**Daytime**	0.20	0.40	106	112	-	-
	Night-time	0.14	0.28	103	109	-	-
Workshops	**Daytime or Night-time**	0.80	1.6	118	124	-	-
Impulsive vibration							
Residences	**Daytime**	6	12	136	142	-	-
	Night-time	2	4	126	132	-	-
Workshops	**Daytime or Night-time**	13	26	142	148	-	-
Intermittent vibration							
Residences	**Daytime**	-	-	-	-	0.20	0.40
	Night-time	-	-	-	-	0.13	0.26
Workshops	**Daytime or Night-time**	-	-	-	-	0.80	1.60

6.5.2 Potential impacts

Solar plant

Construction and decommissioning

Sources of noise emissions associated with construction of the solar plant would include the use of on-site machinery, vehicle movements and other construction-related activities. Typical noise levels of equipment to be used are provided in Appendix D. Modelling was undertaken to estimate expected noise levels at non-involved sensitive receiver locations (refer section 3 of Noise Assessment in Appendix D).

Given the typical noise levels of individual pieces of construction equipment, no individual piece of equipment is likely to exceed the target noise level at any of the non-involved sensitive receivers.

[3] The provided reference level (i.e. re 10^{-6} mm/sec for velocity) allows conversion from the more commonly known units (mm/s) to dB.

Given the typical noise calculation of the 10 most noisy construction equipment working concurrently, the noise associated with solar plant construction activities would exceed the target noise level of 43.7 dBA at Residence 3. The target noise level of 44.9 dBA would not be exceeded at Residence 2.

These calculations are the result of a very conservative approach. The prediction methodology used assumes hemispherical spreading which only accounts for divergence losses (i.e., distance spreading). There are additional limitations beyond wind and shielding effects which have not been specified, including temperature inversions, atmospheric absorption, ground effects, wind effects and shielding effects. Correcting for these factors, for a receiver at a distance 1 kilometre from the noise source, there would be an additional loss of 11 dBA which has not been accounted for in the calculations.

For the construction of the solar plant, construction noise at the closest dwelling (Tikkara, Residence 1) complies with the 42 dBA NML by 4 dBA. For the other properties located to the west and south, the margin of compliance ranges from 8 to 14 dBA (refer to section 4 of Noise Assessment in Appendix D).

It should be noted that these predictions allow for a worst case scenario as:

- The likelihood of the ten loudest items of plant operating concurrently at the closest point to a single receiver is incredibly small. In reality, the equipment will be spread across the area of works.
- The adjustments for ground and air absorption have been conservatively based on the acoustic wave travelling a distance of 1 kilometre. However, receivers are between 1.8 and 4.6 kilometres from the construction works. For these distances the combined losses range from 13 to 20 dBA.

It is anticipated that during typical construction works the level of noise at any receiver will actually be less than that reported, with a larger margin of compliance than stated in this report.

Practical measures are available to mitigate potential construction noise impacts on sensitive receivers (refer section 8.2). Whilst predicted noise from construction impacts is found to comply with all criteria, mitigation measures should still be implemented to minimise any short term adverse impacts. It is considered that with implementation of these measures, residual impacts on sensitive receivers can be reduced to below target levels.

The decommissioning period is likely to be significantly shorter and with significantly fewer truck movements compared with the construction phase. Noise impacts are considered to be manageable.

Operation

Operational noise associated with the project would be minor. During operation, sources of noise would be from the electrical substation, on-site transformers and occasional maintenance activities.

Substation noise

The substation would be located near the southwest corner of the site, with power generated in the solar plant transformed in the substation to grid voltage via a 33 / 132 kV transformer.

Australian Standard AS 60076 Part 10 2009 *"Power Transformers – Determination of Sound Levels"* specifies applicable sound power limits for all transformers based on the transformer rating (in MVA). Whilst the MVA rating of the substation is not provided in the EIS, a conservative assumption is provided below based on a 250 MVA facility, with the installation meeting the requirements of AS 60076. AS 60076 indicates that a transformer of this capacity may produce sound power levels up to 100 dBA. The predicted noise level at the closest property (Tikkara, 2.4 kilometres south of the solar plant substation) is 13 dBA, which is well below ambient background noise levels.

Given that a conservatively large power rating has been assumed, and that all noise sensitive receivers are generally greater than 2 kilometres from the solar plant, noise from the substation will be inaudible.

Noise from maintenance works

During operations 2-3 staff will be required on site to operate and maintain the Solar Plant. Noise from the maintenance works will mostly be due to infrequent maintenance works conducted inside the prefabricated steel maintenance building located in the southwest corner of the site. As such, noise from any maintenance works will be intermittent and occur during the day period only. Given the large distance from the site to the surrounding receivers, noise from most scheduled maintenance works will be well below the NSW Industrial Noise Policy (INP) criteria.

To provide an indicative assessment example of a worst case maintenance activity, noise from a concrete saw (with a sound power level of 117 dBA) would result in a level of 32 dBA at the nearest residential receptor. This is 5 dBA below the INP criteria of 37 dBA.

Transmission line and main access road

Construction and decommissioning

Sources of noise emissions associated with construction of the transmission line and main access road would include the use of on-site machinery, vehicle movements and other construction-related activities. Typical noise levels of equipment to be used are provided in Appendix D.3. Modelling was undertaken to estimate expected noise levels at sensitive receiver locations (refer Appendix D.3). These calculations are based on noise emissions from the closest part of the proposed transmission line or main access road to the receiver. It is noted that at the time of the construction noise assessment, the proposed intersection of the main access road and Barrier Highway had potential to be located anywhere within a distance of approximately 100 metres to the east of the transmission line. It is now proposed to be approximately 90 metres east of the transmission line at the southwest corner of Lot 24, DP751328. This would not increase the assessed noise levels for any of the receivers as the shortest potential distance to each sensitive receiver was used in the assessment.

Given the typical noise levels of individual pieces of construction equipment used for the construction of the transmission line and main access road, no individual piece of equipment is likely to exceed the target noise level at any of the residences. Given the typical noise calculation of the 10 most noisy construction equipment working concurrently, the noise associated with construction activities for the transmission line and main access road would exceed the respective target noise levels at both non-involved residences (Residences 2 and 3).

Construction of the transmission line and main access road are likely to be shorter in duration than solar plant construction works and impacts are likely to be intermittent as works would be undertaken at different parts of the site for varied periods. That is, it is considered unlikely that sensitive receivers would be subject to noise above the targeted levels as there is a low likelihood of the 10 most noisy pieces of equipment being used concurrently in one location for a sustained period.

As above, these results have been taken using a very conservative approach, not accounting for temperature inversions, atmospheric absorption, ground effects, wind effects and shielding effects. Appling correction for these factors, for construction of the transmission line and main access road, predicted noise levels comply by 3 dBA at the closest property (Tikkara). For the other three dwellings, the level of compliance is 8 dBA (refer to section 4 of Noise Assessment in Appendix D).

Practical measures are available to mitigate potential noise impacts on sensitive receivers (refer section 8.2). It is considered that with implementation of these measures, residual impacts on sensitive receivers could be reduced to below target levels.

Decommissioning impacts would be of a similar nature but of lower intensity than construction impacts and are considered similarly manageable.

Operation

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. Aeolian noise is the sound produced by wind when it encounters an obstacle, such as building and wires, causing a humming or other constant sound (Encyclopædia Britannica 2012). In the context of this proposal, aeolian noise could be generated when wind passes over transmission poles or lines. This type of noise is generally infrequent and is dependent on wind direction and velocity. Wind must be steady and perpendicular to the line to cause aeolian vibration. Given the distance to the closest sensitive receiver (2.3 kilometres), aeolian noise impacts are expected to be negligible.

Corona is the breakdown of air into charged particles caused by the electrical field at the surface conductors. The weather and voltage of the line causes variation in corona noise, most often occurring during heavy rainfall and high humidity. Given the distance (2.3 kilometres) to the closest non-involved sensitive receiver, corona noise impacts are expected to be negligible. A minimum line potential of 70 kV or higher is required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components, a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing' and is generally only a feature during foggy or raining conditions.

SLR Consulting have previously measured corona noise (reference GEHA Report 045-109/2 dated 9 November 2004, pers. comm. I. Fricker December 2012) at a site near Officer in outer Melbourne, Victoria. SLR found it possible to measure corona noise at close distances, at high frequencies only, as other noise sources, namely traffic and birds, caused some interference at times. A 500 kV line was measured during damp foggy conditions.

At a distance of 30 metres along the ground from the line an L_{eq} noise level of approximately 44 dBA was measured. At a distance of 100 metres the corona noise was calculated to be approximately 39 dBA. Assuming a minimum night time RBL value of 30 dBA, the minimum intrusive criteria as determined by the NSW Industrial Noise Policy (INP) would be 35 dBA. SLR therefore conservatively estimates that the minimum criteria level of 35 dBA would be complied with at a distance of 240 metres. The proposed transmission route is further than this distance from any receptor and hence any occasional corona noise would comply with the NSW INP minimum limit at all residential receivers.

Vibration

Potential causes of vibration from proposed construction and decommissioning activities may include:

- Continuous construction activity.
- Impulsive vibration such as that caused by the occasional dropping of material, occasional loading and unloading heavy vehicle air breaks, intermittent construction activity.

- Intermittent vibration such as passing of heavy vehicles.

The project would not involve any blasting. Given the distances of the closest non-involved sensitive receivers from the site (2.3 kilometres from the transmission line and 2.8 kilometres from the solar plant site boundary), it is considered unlikely that significant vibration would be experienced by these receivers.

No vibration impacts are anticipated during operation.

6.5.3 Mitigation

A series of management prescriptions, predominantly related to the construction phase, to reduce noise impacts on nearby sensitive receivers and manage potential residual impacts through a process of consultation are provided in section 8.2.

6.6 VISUAL IMPACT

This section summarises the key findings of the Visual Impact Assessment (VIA), undertaken by Fresh Landscape Design. The assessment is provided in full in Appendix D.

6.6.1 Approach

The visual assessment consists of two components, a baseline study and a visual impact assessment. The baseline study is an inventory of the existing visual character and the ways views of the project may be experienced. The visual impact assessment describes, for the available views, the changes in visual character and visual amenity that are expected to result from the development. Specifically, the elements of each component include:

- Baseline study:
    - Definition of study area.
    - Desk study including collection and review of existing literature, tourism information, maps and aerial photos, identification of approximate visibility of the development and identification of potential receptors of view effects.
    - Field survey to validate the actual extent of visibility, identify key and representative viewpoints.
    - Classification of landscape character units and the identification of visual management priorities for particular areas.
- Impact assessment:
    - Identification of the views likely to be affected by the proposal and the sensitivity of viewers at those locations.
    - Identification of visual effects introduced by the development for key and representative viewpoints.
    - Assessment of options for mitigation of adverse visual effects.
    - Evaluation of the level of visual impact and its significance after mitigation.

Public consultation (the combined results of feedback forms disseminated as described in section 4.2 of this EIS) and photomontages (prepared to illustrate visual effects for viewpoints most likely to be impacted) were referenced in the preparation of the visual assessment. Maps and photomontages used in the VIA are provided in Appendix D of this EIS.

6.6.2 Results

The study area was limited to within 16 kilometres of the proposed development. The distance limit is based on the extent of the background distance zone (WAPC 2007) in relation to the project site.

Viewing opportunities and their expected sensitivity were assessed as follows:

- High sensitivity – Barrier Highway, Mitchell Highway, Bogan River, Nyngan and surrounding peri-urban residential areas.
- Moderate sensitivity – Rotary Park, Nyngan Golf Course, Riverside Caravan Park, Nyngan Showground, race course, airport, cemetery, peri-urban non residential areas and rural areas.
- Low sensitivity - State forest, local roads, railways.

The study area was divided into five landscape character units (LCUs) (similar in terms of landform, vegetation patterns, water form and land use patterns) and their scenic quality was assessed as follows:

- LCU1: Nyngan town (moderate scenic quality).
- LCU2: Nyngan peri-urban (high and moderate scenic quality).
- LCU3: Bogan River and floodplain (moderate scenic quality).
- LCU4: State forests (moderate scenic quality).
- LCU5: Rural plains (moderate scenic quality).

Visual management priorities were determined for the study area as follows:

- High - within 500m of Barrier Highway, Mitchell Highway, Bogan River, Nyngan and surrounding peri-urban areas
- Low - in the State forest LCU
- Moderate - in all other parts of study area

Table 6-7 demonstrates the management objectives relevant to these priority levels

Table 6-7 Visual landscape management priorities.

Management priority	Management objectives
High	Maximum retention of visual quality. In these areas the level of landscape alteration allowed is low since these areas are the least accommodating of visual change. It is expected that developments that lead to major change in scenic quality in the short term be avoided and the focus is on maximum protection of all existing visual landscape features.
Moderate	Moderate retention of visual quality. Here the focus is on the protection of dominant existing visual landscape features and landscape alterations may be allowed to be visually apparent.
Low	Optimising and enhancing visual quality. In these areas of relatively low visual significance, landscape alterations may be visually dominant but should reflect the existing lines, forms, colours and textures of the existing landscape.

6.6.3 Potential impacts

Impacts on important views

From the results of the community consultation, there appears to be little concern in the local community about the visual impacts of the proposed development. Views of the Bogan River where nominated as being of special value in the Nyngan area. Given the flat terrain of the study area, there are few opportunities for views from elevated locations (which are often highly valued) and there are no tourist lookouts. The assessment determined that the proposed solar plant and electricity easement is not expected to be visible from Nyngan, the Bogan River, peri-urban areas, Nyngan tourist and recreation facilities, rural areas east of the Bogan River or the Mitchell Highway.

Glare and reflectivity

Photovoltaic panels are designed to absorb sunlight and convert it to electricity. Minimising the light reflected from the panels is a goal of panel design, manufacture and installation. AGL has provided the following information from First Solar about reflectivity for the proposed photovoltaic panels.

> *'Glare and dazzle effects due to reflection from First Solar modules are expected to be minimal and comparable to glass facades. The First Solar modules appear darker than silicon modules in nearly all conditions. This dark appearance is direct evidence that the reflected light from the First Solar modules is less than that from silicon modules.'*

The full application note from First Solar including reflection coefficients is provided in Appendix C of the visual impact assessment report.

The photovoltaic panels would be located more than 1.5 kilometres from the primary view corridor (Barrier Highway), and intervening trees as well as the plant security fence would disrupt the view from the highway. Furthermore, views from the highway are expected to be directed towards the back of the panels rather than the front surface. This arrangement is expected to minimise opportunities for glare and reflectivity for viewers on the Barrier Highway.

Cumulative impact

The solar plant would be unique in the visual catchment. Other rural and industrial style structures are scattered through the landscape but are unlikely to be seen in the same view with the solar plant. The cumulative visual impact resulting from adding the solar plant would be minor to insignificant.

Significance of visual impacts

The flat terrain of the study area, the tree lines along three sides of the site and the relatively low profile of the proposed infrastructure would result in the solar plant being hidden from view for the rural lands to the west, north and east of the site. The solar plant would be visible from parts of the Barrier Highway through gaps in the roadside vegetation but the 1.5 kilometre offset of the solar plant from the highway and the low profile of the solar plant would make it appear almost insignificant in height.

The proposed transmission line would be more easily seen than the solar plant because the poles would be higher than nearby trees and the transmission line crosses the Barrier Highway. Views to the proposed transmission line would generally be of short duration and seen from moving vehicles. The closest farmhouse is 1.8km from the transmission line and views from that house towards the transmission lines are blocked by vegetation. Views towards the transmission lines from other farmhouses would be at least partially screened by existing vegetation and the lines and poles would appear small because of the distance of the viewer.

Sixteen view points were assessed separately, and all were considered to have low impact significance, as summarised in Table 6-8 and illustrated in Figure 6-5 below. Mitigation was recommended for two viewpoints: V15 Barrier Highway line crossing and V17 Barrier Highway – Tikkara. The photomontages below illustrate the existing conditions and expected views of infrastructure from these locations.

Table 6-8 Summary of significance of visual impacts.

Viewpoint	Visual impact significance	Comments
V1 Mitchell Highway South	Low	Development barely visible if seen at all.
V2 Nyngan-Mundaroo Road	Low	Development unlikely to be seen.
V3 Tottenham Road	Low	Development unlikely to be seen.
V4 Nyngan Golf Club	Low	Development unlikely to be seen.
V5 River Street, Nyngan	Low	Development unlikely to be seen.
V6 Peter Sinclair Bridge, Bogan River	Low	Development unlikely to be seen.
V7 Barrier Highway – Riverside Caravan Park	Low	Development unlikely to be seen.
V8 Bogan Road West	Low	Development barely visible if seen at all.
V9 Tullamore-Nyngan Road	Low	Development unlikely to be seen.
V10 Mitchell Highway - Wilgaree	Low	Development barely visible if seen at all.
V11 Pangee Road	Low	Development unlikely to be seen.
V12 Miandetta	Low	Development unlikely to be seen.
V13 Redlands house	Low	Development barely visible if seen at all.
V14 Pic's paddock, Redlands	Low	Top of poles barely visible above distant tree line.
V15 Barrier Highway line crossing	Low	Poles and wires visible close to crossing point, mitigation suggested.
V16 Tikkara house	Low	Development unlikely to be visible.
V17 Barrier Highway - Tikkara	Low	Solar plant barely visible in distance, mitigation suggested.

Map 5 Viewpoints and observation points

NYNGAN SOLAR PLANT
Visual Impact Assessment

- 1 Viewpoints
- Other observation points
- Proposed 132 kV powerline
- Proposed fence
- Rail
- Highway
- Built up area (Nyngan)
- Road
- Existing powerline
- Watercourse
- Development site
- Proposed infrastructure
- 16km from study area

Notes:
- Impact areas were derived from 'AGL - Nyngan Solar Power Station.dwg' provided by the client
- Other base layers from LPI, accessed 2012
- Aerial base layer from Bing (ESRI Online) accessed 2012

0 0.5 1 2 Kilometres

A3 @ 1:150000
Ref: 4554v1.3 VIA
Author: SP

ngh environmental

www.nghenvironmental.com.au

Figure 6-5 Viewpoints and observation points.

Existing conditions (above)

With proposed transmission line crossing highway using 26m high poles on both sides of road (above)

Figure 6-6 Photomontage V15 Barrier Highway line crossing.

Existing conditions (above)

With solar plant (above)

Figure 6-7 Photomontage V17 Barrier Highway – Tikkara.

6.6.4 Mitigation

The development of the Nyngan Solar Plant and electricity easement on the identified site would have a small impact on the existing landscape character in the immediate vicinity. However, the visual impact is considered by the assessment to be low. Minimising clearing of vegetation and establishing additional vegetation in strategic locations (pictured below), as described in section 8.2 of this EIS, would further reduce the visual impact. After vegetation has been established and matures along the southern side of the site, the visual impact of the solar plant is expected to be negligible.

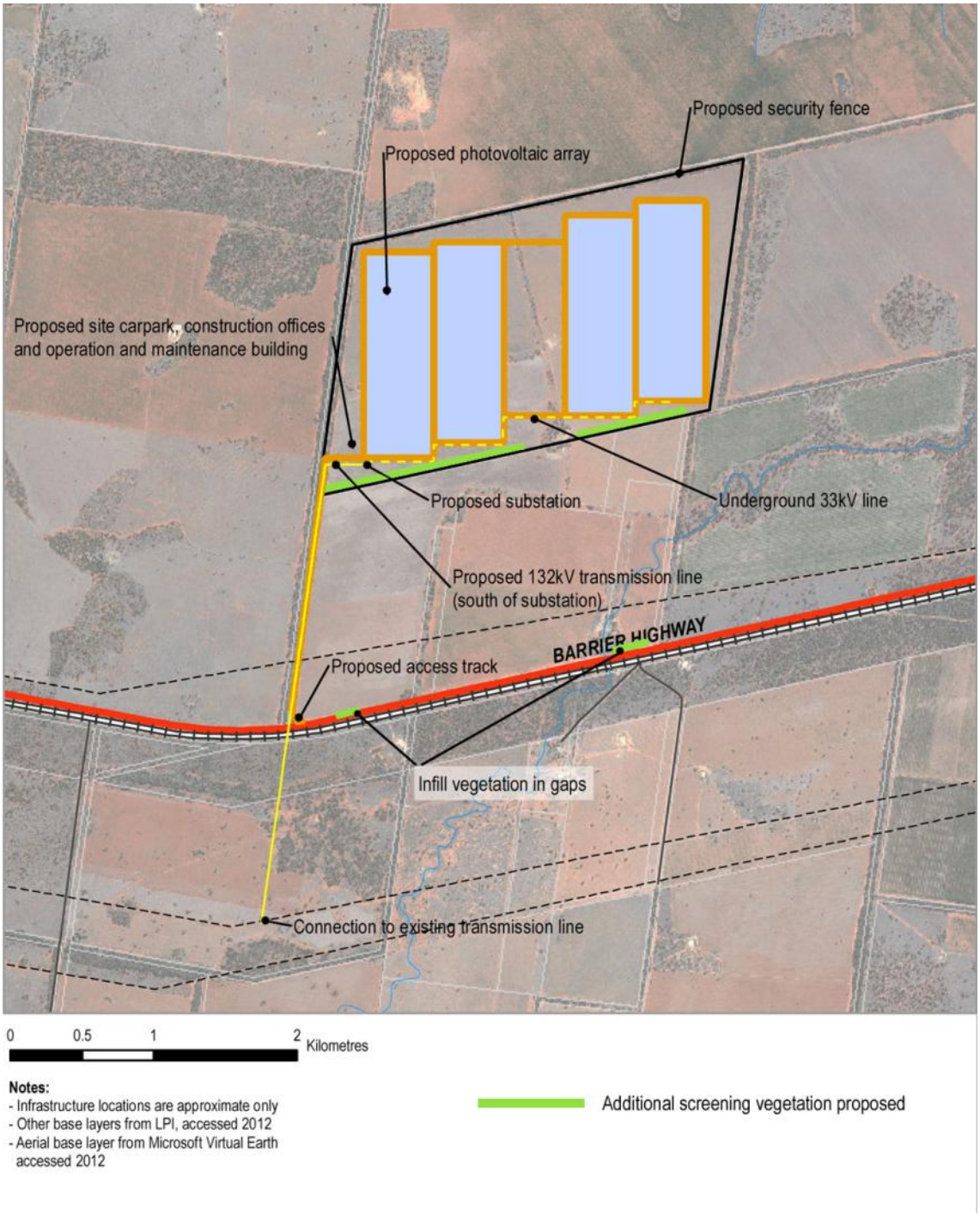


Figure 6-8 Proposed vegetation screening.

7 ASSESSMENT OF ADDITIONAL ISSUES

7.1 AIR QUALITY

Air quality can be affected by dust caused by soil disturbance (e.g., from excavation or vehicle traffic) and emissions from vehicles and machinery. These impacts can be a nuisance to nearby receivers (residences, farm workers). At worst they can interfere with plant growth, degrade ecosystems, represent human health risks and contribute to greenhouse gas emissions and anthropogenic climate change.

7.1.1 Background

Nyngan is located within the Cobar Peneplain Bioregion. The Cobar Peneplain has a hot and dry, semi-arid climate with an average annual temperature of 15-19 degrees Celsius (NPWS 2003). The average annual rainfall is between 259 and 537 millimetres. Summers are hot and temperatures can exceed 40 degrees Celsius (°C) between December and February. Winter is characterised by frost when temperatures can be as low as -6 °C.

The air quality in Nyngan is generally good, and is typical of that found in a rural setting in NSW due to the relatively low population and distance from industrial pollution sources. Local air quality can be affected by traffic fumes, agricultural practices and industrial activities. During colder months, there is a minimal increase in air contaminants due to smoke from the operation of solid fuel heating.

Two major polluters occur in the local region, Hermidale and Girilambone Mines, and are located 30 and 40 kilometres from the proposal area, respectively. Emissions from both mines include carbon monoxide, copper, nitrogen oxides and particulate matter (DSEWPC 2011a).

Settlement within proximity of the site is considered sparse (refer Figure 6-4). Four nearby receivers have been identified within 3 kilometres of the site. The closest, at 1.8 kilometres from the transmission line, is an involved landholder, two are non-involved landholders, and while the fourth appears on maps (Department of Lands 2012), it was confirmed during site inspections as not existing on ground.

7.1.2 Potential impacts

Construction and decommissioning

Dust generation may occur as a result of excavation, earthworks and movement of trucks and work vehicles along unsealed access roads. Significant dust generation may result in complaints from nearby residents. However, the dust impacts resulting from construction are expected to be minimal given that the closest non-involved residential dwelling to the proposed solar plant works is approximately 2.3 kilometres from the transmission line and screening vegetation is present between the works and all potential receivers. Dust impacts are considered further in section 7.9.

No climatic impacts are anticipated to be generated during the construction or decommissioning phases of the project.

The construction of the proposed solar plant and transmission line is not anticipated to have a significant impact on air quality. Identified impacts are highly manageable.

No air quality impacts in addition to those mentioned for construction are anticipated during the decommissioning phase. Any impacts would be highly manageable.

Operation

The generation of solar energy during the operation of the proposed solar plant would not generate any emissions or affect air quality. During operation the proposal would have a positive impact on global climate by reducing Australia's reliance on fossil fuels for electricity generation. The operating PV modules at the solar plant would emit no greenhouse gases (U.S. Department of Energy 1994).

Annual maintenance activities would result in some localised, intermittent vehicle emissions and potentially some generation of dust from vehicles travelling across the access tracks. The impacts on local and regional air quality are expected to be negligible.

7.1.3 Mitigation

A commitment to implement protocols to minimise and address vehicle and dust emissions is provided in section 8.2.

7.2 HEALTH AND SAFETY

7.2.1 Background

Electromagnetic fields (EMFs) consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunder storms and Earth's magnetic field (WHO 2012).

Electric fields are produced by voltage and magnetic fields by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances (WHO 2007). Electric and magnetic field strengths reduce rapidly with distance from the source, and while electric fields are shielded to some extent by building materials, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50 Hertz (Hz). This frequency falls within the Extremely Low Frequency (ELF) range of 0-300 Hz.

As electricity use has become an everyday part of life, concerns have been raised about the potential for exposure to EMFs to adversely affect human health. Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO undated). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project has thus far concluded that there are no substantive health consequences from exposure to ELF *electric* fields at the low levels generally encountered by the public (WHO 2007), such as those that would be produced by electricity generation at the Nyngan Solar Plant and along the transmission line.

Whether exposure to ELF *magnetic* fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA 2011) advises that 'the scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found near transmission lines is a hazard to human health', and that 'current science would suggest that if any risk exists, it is small'.

Australia does not currently have a standard regulating exposure to extremely low frequency electric or magnetic fields. ARPANSA refers to the limits in the National Health and Medical Research Council's (NHMRC) *Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields* (1989).

Table 7-1 Summary of the Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields.

Exposure characteristics	Electric field strength (volts per metre - V/m)	Magnetic flux density (microteslas - µT)
Occupational		
Whole working day	10,000	500
Short term	30,000	5,000
General public		
Up to 24 hours/day	5,000	100
Few hours/day	10,000	1,000

The proposal includes four main types of infrastructure that could create EMFs: an overhead 132kV transmission line, underground 33kV cables, a substation and the solar array itself. Typical and maximum EMF levels for these types infrastructure are discussed below. Strength attenuates with distance from the infrastructure, as seen below.

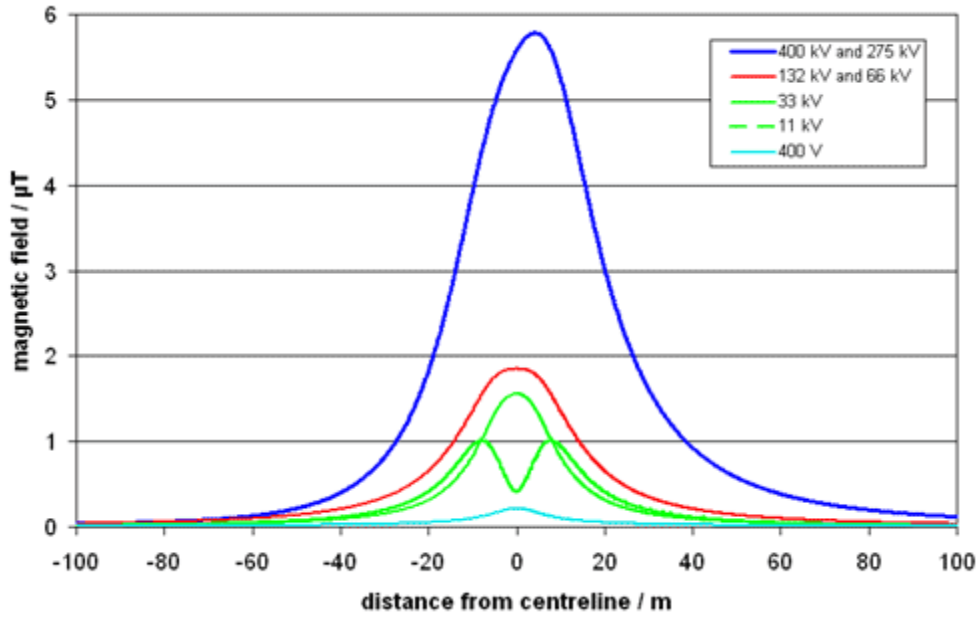


Figure 7-1 Typical magnetic fields from overhead powerlines.

(Source: EMFs.info 2012)

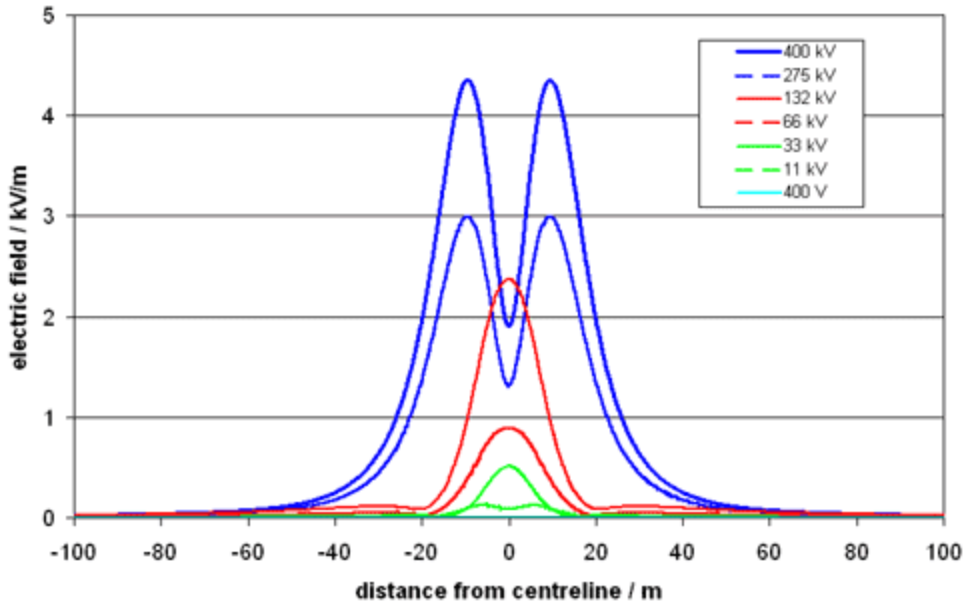


Figure 7-2 Typical electric fields from overhead powerlines.

(Source: EMFs.info 2012)

ARPANSA (2011) provides the following typical levels of magnetic fields near transmission lines and substations.

Table 7-2 Typical electric fields from overhead powerlines.

Source	Location of measurement	Range of measurement	
		(mG)	(µT)[4]
Transmission line	Directly underneath	10 - 200	1 - 20
Transmission line	At edge of easement	2 - 50	0.2 - 5
Substation	At substation fence	1 - 8	0.1 – 0.8

EMFs.info (2012) provide maximum and typical ground-level field levels for both electric and magnetic fields from 132 kV overhead transmission lines in the UK, which, like Australia, operates at a 50Hz frequency.

Table 7-3 Typical EMF levels for 132kV transmission lines.

	Electric Field (v/m)	Magnetic Field (µT)
Maximum field (under line)	4,000	40
Typical field (under line)	1,000 – 2,000	0.5 – 2
Typical field (25m to side)	100 - 200	0.05 – 0.2

[4] Converted from mG where 1 mG = 0.1 µT.

Underground 33kV cabling does not produce external electric fields due to shielding from effects of the soil, however magnetic fields still occur. EMFs.info (2012) provides some typical magnetic field data for a single 33kV underground cable at 0.5m depth.

Table 7-4 Magnetic field levels from underground 33kV cabling.

Magnetic Field (µT) at distance from centreline			
0 m	**5 m**	**10 m**	**20 m**
1.00	0.29	0.15	0.07

Research into electric and magnetic fields undertaken at utility scale photovoltaic installations in California[5] by Chang and Jennings (1994), indicated that magnetic fields (the EMF type of greatest public concern) was significantly less for solar arrays than for household applications. Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

7.2.2 Potential impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the project. Site staff would be exposed over intermittent periods during works at and around the existing 132kV and 66kV transmission lines that occur along the proposed 132kV transmission alignment. The maximum magnetic field of the existing transmission lines are well under the 100 µT and 500 µT limits respectively recommended for public and occupational exposure. Similarly, the maximum electric field of a 132kV transmission line is less than the recommended 5000 V/m, and at the 66kV line can be expected to be even lower than the 132kV. Given the voltage workers would be exposed to and the intermittent nature of exposure, the effects are likely to be negligible.

Operation

During operation, EMF sources would include the 132kV transmission line, substation, and the solar arrays incorporating 33kV underground cables.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts avoided.

The site is surrounded by agricultural land and public access would be further restricted by site fencing around the solar array and substation. EMFs from the solar plant are likely to be indistinguishable from background levels at the boundary fence. The underground 33kV cabling would not produce external electric fields due to shielding from soil, and its magnetic fields would be limited in the order of 1 µT directly above the cabling and falling away to 0.7 µT at a distance of 20 metres (EMFs.info 2012). These levels are well within the public and occupational exposure levels recommended by ARPANSA.

[5] Note the U.S.A electricity supply operates at 60 Hz frequency

The substation would also be fenced. While there are number of EMF sources within a substation, design procedures relating to equipment selection, layout, electrical connection techniques and compound size would ensure the EMFs produced by the equipment within the station would also be typically indistinguishable from background levels beyond the substation fence. The substation design would be similar to other designs used throughout Australia that have had EMF measurements taken to ensure levels within the compound are within recommended occupational exposure limits for staff.

The largest potential for public exposure would be associated with the 132kV transmission line alignment, which crosses the Barrier Highway and the adjacent Crown land. Public exposure would be fleeting and intermittent when accessing those areas, and typical EMF levels produced by a 132kV transmission line are well below ARPANSA's recommended exposure limits outlined in Table 7-1.

Staff exposure to EMFs from the proposed and existing transmission lines would be intermittent during site access and maintenance activities, and again EMF levels produced would be well within the recommended occupational exposure limits outlined in Table 7-1.

Using the Principle of Prudent Avoidance to design and site this infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

7.2.3 Mitigation

Health and safety risks are addressed primarily through design measures, detailed in section 8.2.

7.3 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

The nature of a given development will determine whether a permanent land use change occurs as a result of the development proceeding (e.g., residential subdivision) or whether the development is reversible and existing or alternative land use can occur in future. Land use impacts likely to result from the proposal, and their reversibility, are discussed below.

7.3.1 Background

The proposal area is currently used for agriculture, mainly sheep grazing. Cropping for the purpose of forage, associated with sheep grazing, is also undertaken within the subject lot. Agriculture is a significant land use in the local area, with over 1.2 million hectares of land dedicated to agriculture within the Bogan LGA and a gross value of over $50 million in 2006 (ABS 2006).

Metallic mineral deposits are known to occur in the locality including a nickel deposit approximately 3 kilometres northwest of the proposal area and nickel-copper deposits occur further northwest and west (DPI 2012). There are several operational mines in the Nyngan locality including the open cut pits of the Tritton Copper Mine, owned by Straits. The pits are located approximately 30 kilometres northwest and 40 kilometres north/northwest of the proposal area at Hermidale and Girilambone, respectively. The Tritton Copper Mine has a seven year mine life, based on 25,000 tonnes per annum copper production (Straits 2012).

Exploration licences entitle the holders to carry out exploration and prospecting for minerals within the specified area. An Exploration Licence Application (Mineral Title Application ELA 4605, Ochre Resources Pty Ltd) is proposed over the solar plant site. The current mineral titles and Exploration Licence Applications held in the Nyngan region are illustrated below.

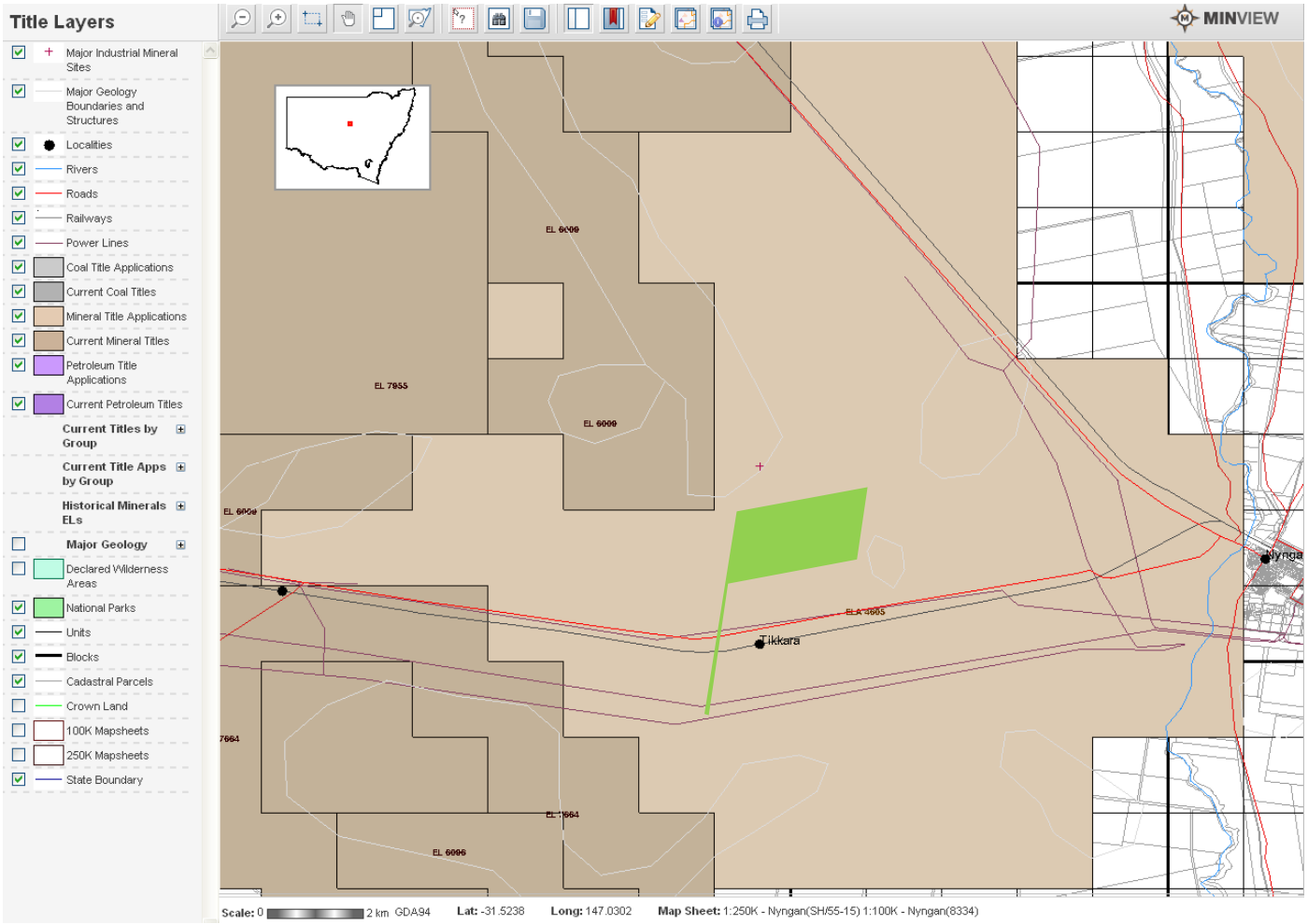


Figure 7-3 Mineral titles and Mineral Title Applications near the proposal site.

Source: DPI 2012

Carter's Innaminna Pit is located approximately 1 kilometre north of the site within Lot 9 DP751328. According to NSW Minerals and Petroleum (Division of Resources and Energy), major commodities from this pit include unprocessed construction materials (DPI 2012). Bogan Shire Council is the operator of this pit.

The 132kV transmission line connecting the solar plant to the existing electrical grid would traverse three private land holdings, a Crown land parcel and the Barrier Highway road reserve. The private land holdings are agricultural properties. The Crown Land and Barrier Highway road corridor retain woodland vegetation and thereby provide a benefit in terms of facilitating wildlife movement.

The proposal site and all land immediately surrounding it is zoned RU1 Primary Production, with the exception of the Barrier Highway zoned SP2 Infrastructure (Classified Road). The proposal is not located on land proposed for rural residential development in local planning instruments, nor is it on land managed for forestry or conservation purposes. The closest land zoned for forestry is approximately 7 kilometres to the north west.

7.3.2 Potential impacts

Construction

Land use

During construction, agricultural activities would cease in areas required for access and construction of the solar plant. Fencing would allow grazing within close proximity of the works areas however. Collision risks from increased vehicle numbers may affect grazing nearby.

Construction of the transmission line would result in temporary loss of access to land along the transmission line easement during the construction period. Construction impacts would be short term and limited in extent.

No land use conflicts are likely during construction in terms of rural residential development, or land managed for forestry or conservation purposes.

Minerals

The extraction of minerals would be restricted during the construction period. The project is, however, highly reversible. Mineral exploration would not be sterilised in the long term as a result of the project.

Operation

Land use impacts

Grazing remains an option for the landholders during the operation phase of the project. However, reduced groundcover growth is expected under the array and must be managed to prevent erosion as a priority over grazing.

Trees and tall shrubs would be suppressed under the transmission line to assist maintenance of infrastructure. However, grazing and cropping within the easement would be possible.

No land use conflicts are likely during operation in terms of rural residential development, or land managed for forestry or conservation purposes.

Minerals

There are no current mineral titles over the proposal area. There is currently a mineral title application for an exploration licence over the subject area. Should minerals be located beneath the solar plant or transmission line infrastructure, extraction would be limited for the operational life of the project. The project is, however, highly reversible. Mineral exploration would not be sterilised in the long term due to the project.

Decommissioning

Subsequent to completion of the project, the site would be rehabilitated (discussed in section 6.2) with the aim of leaving similar or better vegetation cover at the site. Some compaction on access roads would likely affect soil structure for cropping but can be remediated as a part of rehabilitation.

The land use change proposed is considered temporary as the proposal is viewed as largely reversible; at the end of the project all above ground infrastructure would be removed and current agricultural land use activities could resume or other land uses in the area, such as residential development or mining, could be considered. Potential for mineral exploration would not be impacted after the decommissioning process, with the exception of small areas of footings that may be retained.

7.3.3 Mitigation

Potential for land use impacts is proposed to be addressed via consultation with neighbouring landholders and mineral stakeholders, as detailed in section 8.2.

7.4 SOCIOECONOMIC AND COMMUNITY

Large or novel developments can produce social and economic impacts on local communities. These can be positive, such as the provision of employment and increased retail trade, as well as negative, such as creating strains on community infrastructure or stress about the unforeseen side effects of change.

7.4.1 Background

The Bogan Local Government Area (LGA) has a population of 2,900 people according to the 2011 Census Quick Stats (ABS 2012). This represents a population decrease of 3.2 per cent since the 2006 Census (2998 people). The percentage of people of Indigenous origin (14.4 per cent in 2011) is very high compared to the Australian average (2.5 per cent in 2011). The overseas immigrant population is small; 88.5 per cent of the population were born in Australia compared to the Australian average of 69.8 per cent (ABS 2012). Industry and Employment statistics is not yet available for the 2011 ABS census data. ABS (2006) data indicates the main industry of employment is sheep, beef cattle and grain farming, involving 27.6 per cent of the population, while the unemployment rate for Bogan Shire is 7.8 per cent, compared to the national rate of 5.2 per cent.

The economy of Bogan LGA is based on agriculture, including broadacre cropping and sheep and cattle production. Olive growing is a new agricultural industry in the Bogan area. Two underground copper mines operate 60 kilometres from Nyngan. The mining operations have generated significant economic growth in the area, particularly in the housing sector.

Nyngan is a service centre for the area:

- Accommodation options in the township of Nyngan include three motels, two caravan parks, two hotels and two bed and breakfasts (Bogan Shire Council 2012).
- Educational facilities within the Bogan Shire include a high school, five primary schools, a pre-school, a mobile pre-school, TAFE campus and other training facilities at the Nyngan Network (Bogan Shire Council 2012).
- Nyngan Hospital consists of a network of health professionals and amenities including a nursing home complex, baby health centre and community health centre (Bogan Shire Council 2012).
- Recreational and sporting facilities in Nyngan include facilities for bowls, golf, tennis, dancing, swimming, rugby, touch football, cricket, netball, fishing, little athletics and pony club (Bogan Shire Council 2012).
- Tourist attractions within the Bogan Shire LGA include: the Bogan River, Macquarie Marshes, Nyngan Museum, helicopter to commemorate the evacuation of residents during the 1990 flood and the Cobb & Co. Heritage Trail (tour 1 and 2).

Community feedback on the Nyngan Solar Plant

Community feedback forms were disseminated in accordance with the community consultation plan (Appendix D), to make sure the broader Nyngan community's concerns were thoroughly identified and to ensure important local information was not missed. As at 30 September 2012, seven feedback forms had been received, all of which provided positive feedback on the proposed Nyngan Solar Plant. Four of those seven respondents registered to receive future community updates on the proposal, along with an additional two people who registered at the Nyngan Ag Expo 2012.

Results of the feedback received are summarised in the below table.

Table 7-5 Summary of community feedback form responses (as at 30 September 2012).

Topic	No. of responses	Response
Local area values	7	7 selected community / family ties 6 selected work opportunities 5 selected recreation opportunities (including natural environment) 2 selected historic values 1 selected views Where preferences were allocated, community / family ties, work and recreation opportunities were regularly rated the highest.
Distance respondent lives from plant	6	No respondents live within 5 km of the plant. 4 respondents live within 10 km and 2 within 50km
Special views in and around Nyngan	2	Both responses nominated views of local waterways, specifically the Bogan River
Solar Plant likes	7	6 specified the use of solar energy/efficiency of generation 2 indicated environmental outcomes (1 highlighting 'no emissions') 1 specified benefits for the local economy
Solar plant dislikes	7	6 stated they had no dislikes or concerns about solar plants, while 1 indicated solar plants were good.

Topic	No. of responses	Response
Concerns or thoughts on specific topics	5	Responses were largely 'nil' or no response was registered 1 acknowledged noise would only be during development 1 suggested a bus tour of the plant for interested people 1 noted job opportunities and tourism
Other comments	1	1 respondent advised they had solar panels

7.4.2 Potential impacts

Construction

The construction phase marks the beginning of the project in the eyes of the local community. It can be a time when uncertainty or opposition to the development becomes apparent. Large scale solar plants can create polarised reactions in communities; some would see it as a large change to existing land use, lifestyles and land character while others would see it as a beneficial change to less polluting forms of electricity generation and as a symbol of progress.

The construction of the solar plant would utilise up to 300 staff at peak construction. Many of these could be drawn from the local area. Additional workers moving to the area temporarily may stimulate local economic activity. Conversely, this may place pressures on services, facilities and infrastructure such as accommodation, schools and health services.

The local community would benefit from AGL's active engagement in supporting community activities, including sponsorship of the 2013 and 2014 Nyngan Ag Expo and sponsorship of the Bogan Shire Christmas Lights competition.

Operation and decommissioning

Minimal impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be at low levels. Decommissioning would offer similar economic benefits to construction and may also include local recycling of infrastructure components.

7.4.3 Mitigation

Potential for adverse socio-economic impacts is proposed to be addressed via consultation with community stakeholders, including industry representatives, as detailed in section 8.2.

7.5 TRAFFIC, TRANSPORT AND ROAD SAFETY

For the proposed Nyngan Solar Plant, key traffic and transport impacts relate to haulage during construction, as increased vehicle numbers can increase traffic collision risk, cause damage to roads and generate noise and dust.

The Bogan Shire Council indentified issues relating to traffic, transport and road safety as important during the development of DGRs for this proposal (refer Table 4-1), as did Roads and Maritime Services (RMS) during additional agency consultation. Specific issues raised by the Council and RMS are addressed in this section.

7.5.1 Background

The region is served by road (the Barrier and Mitchell Highways) and rail (the Main Western railway line). Both are of sufficient capacity to accommodate the haulage of components required for the construction of the solar plant and transmission line. However, there is no rail into the proposed construction site, so if rail was used as the main haulage option, trucking would still required from the nearest station to the site (either Nyngan or Miandetta). This would result in double handling and increased potential for breakages, and would therefore be likely to incur higher costs than road haulage. It is therefore proposed to use road haulage for transporting material to the site.

The Barrier Highway (National Highway 32) is the main road transport route in the region, continuing from Nyngan to Cobar, Wilcannia and Broken Hill. Annual Average Daily Traffic (AADT) levels at the Bogan-Cobar Shire boundary on the Barrier Highway, west of Nyngan, were 653 in 2002 (RTA 2002[6]) . The Mitchell Highway connects Nyngan to the east through Dubbo and Bathurst. The Great Western Highway connects Bathurst to Sydney. These traffic levels on the Barrier Highway near Nyngan are considered relatively low, although the number of heavy vehicles may have increased slightly over the past 10 years.

While the haulage route has not been determined, it is expected that the project's components would be delivered by road from Port Kembla (Sydney) or Adelaide to the site.

The solar plant site is located approximately 1.6 kilometres north of the Barrier Highway and approximately 10 kilometres west of Nyngan. The site is currently accessed by an unnamed, unsealed private road, aligned north and perpendicular to the Barrier Highway, through the signposted 'Coreen' property gate located immediately opposite the Rutherglen Road turnoff. Another existing farm gate provides access into the treed corridor immediately west of the proposed transmission line easement, however, sightlines at this location are affected by the alignment of the highway and roadside vegetation.

The location and form of the main access road junction with the Barrier Highway would ensure adequate sightlines are provided when entering and exiting the site (safe intersection sight distance of 300 metres minimum). The intersection would be located approximately 90 metres east of the southwest corner of Lot 24, DP751328. The section of the Barrier Highway where site access would be located is a sealed, single carriageway public road, administered by RMS. The speed limit is 110 km/hr. Construction works would be undertaken to provide widened bitumen sealed shoulders permitting safe access around a turning vehicle as well as adequate turning paths for heavy vehicles. This treatment is referred to as a BAR/BAL layout in Austroads Guide to Traffic Engineering Practice and is most likely to be the minimum treatment recommended by RMS. The shoulders would be bitumen sealed and the seal would extend along the access road for at least 20 metres from the property boundary to reduce dust and pavement damage by turning vehicles.

The total area of the construction site is in excess of 4 square kilometres and sufficient area is available for the parking of many hundreds of vehicles. It is proposed to limit the number of employee parking spaces on site and encourage the use of bus transport to the site. Preliminary plans for the site propose parking for approximately 110 vehicles.

The proposed timeline for the project indicates that approximately 150 to 200 employees will be required during the initial 6 months with up to 300 employees during the peak construction period. This period is expected to be approximately eight months whilst the PV modules and support structures are erected.

[6] While no current figures are available from the RMS, the ABS (2012) state the region has experienced an overall population decline since 2002 and hence this figure is not likely to be an underestimate.

Following erection of the PV modules the employee numbers will reduce toward the end of the 18 month construction programme.

7.5.2 Potential impacts

Construction and decommissioning

The potential traffic, transport and road safety impacts associated with construction and decommissioning of the proposal relate primarily to increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (where traffic is on unsealed roads) which may adversely affect nearby receivers.
- Disruption to existing services.
- Reduction of the level of service on the road network caused by "platooning" of vehicles.

Project-specific vehicle numbers are expected to comprise:

- Haulage traffic to deliver components, primarily concentrated at the beginning of the construction program.
    - Articulated heavy vehicles to transport 12 metre shipping containers from a coastal port. It is expected that these deliveries will comprise up to 30 trips per day [7] for the first year of construction). This volume is based on a 19 metre long single articulated vehicle. The number of vehicles could be reduced significantly with the use of road trains which would carry two or possibly three containers (depending on weight). Road trains are classified as "restricted access vehicles". These vehicles are currently permitted to operate in NSW west of Dubbo and through to Adelaide in South Australia via Broken Hill. (Road trains can have a two or three trailer combination and vary in length from 36 metres to 53 metres). Figure 7-4 shows possible road routes for delivery of components. Routes would follow the Mitchell Highway through Nyngan, turning left onto the Barrier Highway to transport goods to the proposal site.
    - Oversize and/or overmass vehicles delivering components such as the substation transformer and transmission line poles. The number or these vehicles is expected to be low and will be required to obtain appropriate permits through the RMS. The number of oversize vehicles is included in the estimate above.
- Plant and machinery. Once these have arrived onsite, they would be primarily restricted to onsite travel until the end of the construction program.
    - Utilities to transport materials and equipment within the site and to pick up local materials (numbers included in estimate above).
    - Trucks to transport larger materials, equipment and machinery (numbers included in estimate above).
- Staff accessing the site daily with limited onsite travel:
    - Shuttle buses from Nyngan to transport the majority of the 200-300 construction personnel required onsite. Assuming an 80% uptake rate and 20 person capacity,

[7] A 'trip' is a one way vehicle movement, hence return travel of one vehicle is noted as two trips.

up to 24 bus trips would be required per day during the construction program. During non-peak periods approximately half as many shuttle buses are expected to be required.

- Cars – private vehicles to and from site to local accommodation and services. It is estimated that 40-80 trips would be required per day, during the construction program. During non-peak periods approximately half as many would be expected.

Traffic impacts would largely be confined to standard hours of construction. Exceptions would occur as staff arrive and leave the site, before and after shifts; some of this traffic may occur outside the standard construction hours. Additionally, the delivery of large components may take place outside normal working hours.

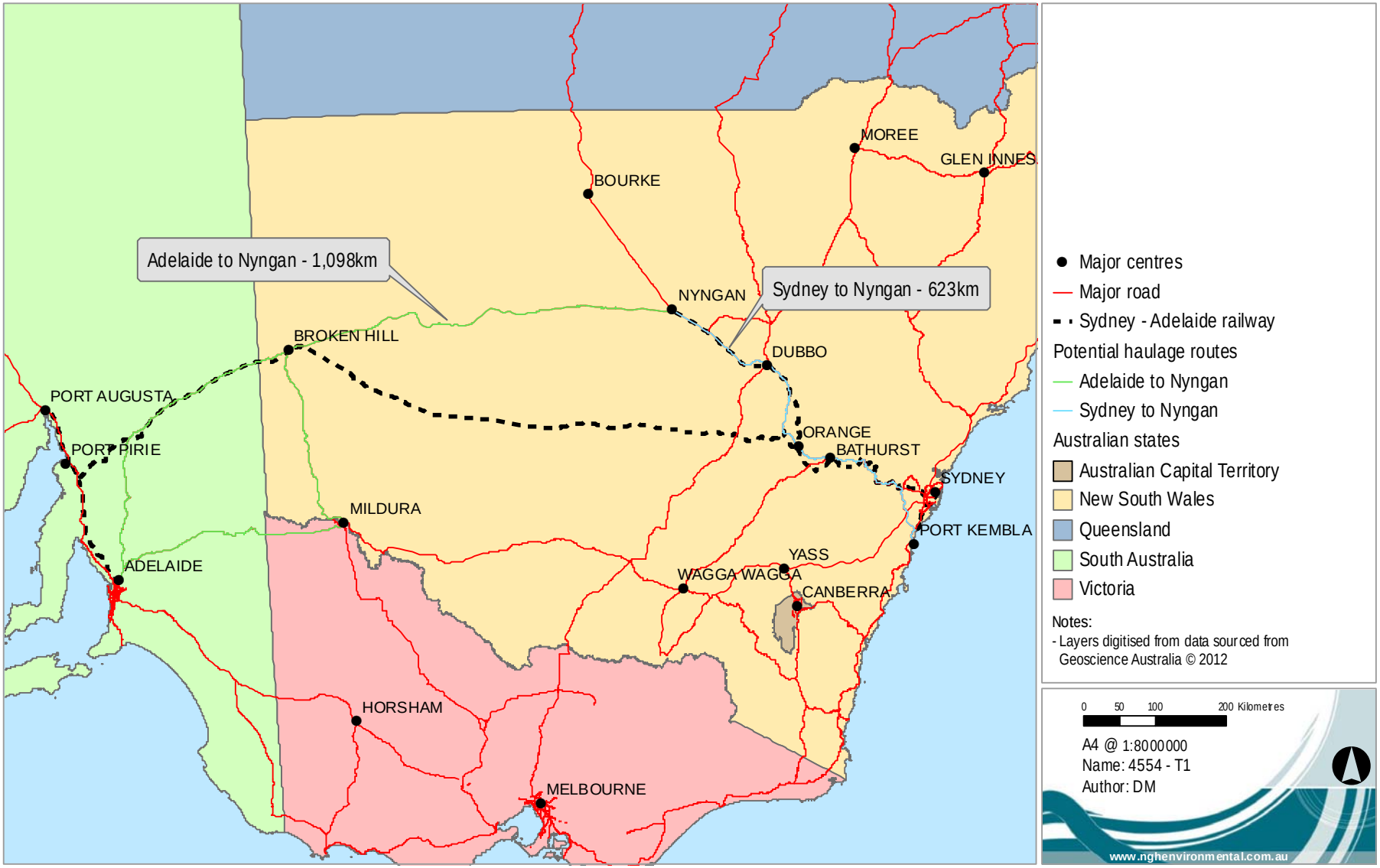


Figure 7-4 Road haulage route options.

The impacts of traffic at road junctions and along the feeder roads generally occur during the peak hour and design guidelines for the selection of intersection treatments are generally based on these volumes. It is estimated that the peak hourly traffic can be reduced to less than 50 vehicles per hour in the peak hour provided that access to the site by employee vehicles is limited. The peak traffic volumes can be reduced by staggering start and finish times.

Delivery times of components can be scheduled with the haulage contractors so that "platooning" of large vehicles on the highways does not occur.

Decommissioning impacts are likely to follow a similar pattern as components are dismantled and removed, over a lesser time period.

Increased collision risks

The increased collision risk relates primarily to traffic entering and exiting the site from the Barrier Highway. This relates to both oncoming traffic and traffic following turning vehicles. The location and form of the main access road intersection with the Barrier Highway may require some vegetation removal or lopping to achieve adequate sight lines. Slowing vehicles may also present a risk to through traffic, requiring signage to warn motorists of the construction time frames.

The site is on a school bus route (Miandetta – Nyngan). The project would increase risk to students boarding and exiting the bus in this location, and crossing the road along transport routes with higher traffic volumes. Consultation with local schools may be required to address the need to move any existing stops to a suitable distance away from the intersection.

Damage to road infrastructure

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. To Nyngan, the impact is expected to be negligible, due to the existing capacity of the road network, but the impact of turning traffic at the intersection to the plant's main access road would require monitoring to ensure it remains within the expected peak hourly volumes. Similarly, roads that are used to access the transmission line would require monitoring to maintain safe conditions for all motorists.

Internal site access tracks would be constructed or upgraded as required to accommodate the projected volumes and loads of construction traffic. The tracks would be compacted but unsealed. During construction, water would be used to minimise dust generation.

Associated noise and dust

The proposed works may result in increased noise and dust, particularly on unsealed roads. Impact from dust generated from the proposed activity, including that associated with increased traffic, is considered in section 7.9.

The DECCW (2011) *NSW Road Noise Policy* (NSW RNP) been used to evaluate impacts from road traffic noise. This policy outlines a range of measures required to minimise road traffic noise and its impacts, including noise generated by developments that generate additional traffic on existing roads.

The criteria for various road categories and land uses are presented in section 2.3 of the NSW RNP. Those criteria are presented in Table 7-6.

Table 7-6 Applicable NSW Road Noise Policy (DECCW 2011) noise criteria.

Type of project/land use	Assessment criteria – dB(A)	
	Day (7am – 10pm)	Night (7am – 10pm)
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, (15 hour) 60 (external)	LAeq, (9 hour) 50 (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq, (1 hour) 55 (external)	LAeq, (1 hour) 50 (external)

One non-involved residence may be affected by traffic accessing the solar plant site and onsite traffic during construction. As it is some distance from the main access road (approximately 2.65 kilometres), screening vegetation is present and the residence is also currently affected by the Barrier Highway traffic noise, exceedance of these levels is considered unlikely. Monitoring would be undertaken to ensure that noise is managed according to the above criteria during works, in the event a noise complaint is received during construction (refer mitigation measure 30 in section 8.2).

Disruption to existing services

The increase in traffic volumes and slow turning vehicles may have a minimal effect on bus schedules, including the school bus (Miandetta to Nyngan on school days) and Countrylink bus services (515/516 Dubbo - Nyngan – Cobar – Broken Hill return 7 days) (515: Nyngan 16:15 – Cobar 18:15, 516: Cobar 9.55 – Nyngan 11.25). The increased traffic associated with the proposal has the potential to affect four bus services on weekdays and two bus services on weekends. These delays will be minimised by the construction of a sealed shoulder on the southern side which will permit through vehicles to pass turning vehicles at a safe speed.

Additionally, local traffic in Nyngan would be affected by increased vehicles from staff seeking accommodation and services in Nyngan, and conducting commercial activities related to the solar plant. This would extend outside construction hours.

Operation

Vehicles would use the designated road network to access the site and travel within the site during the operational phase (30 year period). Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar plant. Operational staff would be confined to designated parking areas and access roads/tracks within the site.

During plant operations, 2-3 workers would access the property to operate and maintain the solar plant. Additionally, security personnel may also access the site. The anticipated volume of staff (<4) would result in a very minimal increase in traffic flow on the Barrier Highway and adjacent roads. It is considered highly unlikely that operational traffic would obstruct public or private access. Risks to road safety from operational traffic would be very minimal.

7.5.3 Mitigation

Traffic and haulage impacts would be managed in consultation with the roads authorities, covering issues such as, but not limited to, reinstatement of pre-existing road conditions, shuttle bus transport,

intersection upgrade, scheduling of deliveries and traffic controls (speed limits, signage etc), as detailed in section 8.2.

7.6 RESOURCE USE AND WASTE GENERATION

7.6.1 Photovoltaic modules

Production of cadmium and tellurium

First Solar's cadmium telluride PV modules are manufactured from cadmium and tellurium, both of which are by-products of smelting processes for other metals. Cadmium is a by-product of smelting zinc ores (~80%), lead ores (~20%) and to a lesser degree copper ores. Zinc is produced in large quantities and therefore large amounts of cadmium are produced as a by-product. The cadmium is either used, concreted encased and stored, or disposed of as hazardous waste. Fthenakis (2004) argues that using cadmium in the production of CdTe PV modules is a relatively safe option and is preferable to disposal. Tellurium is a rare metal and is generally extracted as a by-product of processing copper, lead, gold and bismuth ores. Recycling of CdTe PV modules is another source of tellurium.

Resource use

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process. A life-cycle assessment was conducted by Fthenakis (2003) for CdTe PV modules. Fthenakis (2003) found that the two leading methods of producing CdTe thin film are electrodeposition and vapour. Both methods use cadmium efficiently; about 1% of the cadmium is wasted in electrodeposition and about 10-30% is wasted in vapour-transport. Waste cadmium can be collected in both processes.

The operation of CdTe PV modules would not result in any emissions and the risks to the environment from large scale use of CdTe PV modules are very low. Decommissioning of CdTe is unlikely to produce any emissions (refer information about recycling below). The atmospheric emissions of cadmium during all phases of the module's life are estimated to be about 0.02g of Cd/GWh (Fthenakis 2003).

The 'energy payback time' for CdTe PV modules has been estimated as 1 year for a solar installation in Ohio, USA and at 0.8 years for a solar installation in Germany (Fthenakis *et al*, 2009). The studies in the USA and in Germany assumed an irradiation of 1700 kWh/m^2/yr and an overall efficiency of CdTe PV modules of 10.9 percent (based on modules produced in 2009). It should be noted that the average efficiency of First Solar CdTe PV modules has risen to 12.7 percent as of the third quarter of 2012 (First Solar 2012c). Given this increase in module efficiency, combined with higher irradiation levels experienced at Nyngan (1825 to 2129 kWh/m^2/yr [8]), the energy payback period for the Nyngan Solar Plant is likely to be shorter than the periods outlined above.

The ratio of energy produced by a solar PV system over its lifetime to the energy required to make it is referred to as the system's energy yield ratio. Mackay (2009) estimated that a roof-mounted, grid-connected solar system in Australia would have an energy yield ratio of greater than seven, indicating the system would produce more than seven times the amount of energy required to make it. This positive

[8] Calculated using an average daily solar exposure annual range of 18-21 megajoules per square metre converted to kWh/m^2 using a conversion factor of 1kWh to 3.6 megajoules and multiplied by 365 to obtain a yearly figure.

energy yield ratio also means that greenhouse gas emissions generated from the production of solar energy systems are more than offset over the systems' life cycle, as there are no greenhouse gas emissions generated from their operation (GA and ABARE 2010).

Ability to recycle modules

Materials used in the construction of CdTe PV modules can be recycled, including the recovery of cadmium and tellurium. Fthenakis and Wang (in press) found that cadmium and tellurium could be leached from decommissioned CdTe modules using an acidic media. A high level of cadmium separation could be achieved at an estimated capital and materials cost of about 2 cents/W for a 10 MW/year recycling facility.

Additionally, it is noted the module supplier for the Nyngan Solar Plant, First Solar, is strongly committed to:

> *'Practicing the environmental philosophies of extended producer responsibility and product life cycle management, which take into account the environmental impact of our products from raw material sourcing through collection and recycling* (First Solar 2012a).

This is evidenced by First Solar having voluntarily established the photovoltaic industry's first module collection and recycling program (First Solar 2012g).

Comparison with other electricity generation options

GA and ABARE (2010) identified coal (at 54%) as the main energy source produced in Australia in 2007-2008 on an energy content basis. Comparisons between the CO_2 equivalents of different power generation methods are provided in Table 7-7. Using energy output in kWh to compare emissions, solar plants using photovoltaic technology produce a tiny fraction of the CO_2 equivalent emissions of more conventional coal- and gas-fired power stations.

Table 7-7 Comparison of CO_2 equivalent emissions produced per kilowatt hour.

Generation method	Emissions produced (grams CO_2 equivalent per kWh)	Source
Solar PV plant	**19-59**	**Wright and Hearps (2010)**
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema *et al*. (2006)

Solar plants are favourable in a number of aspects when compared to the major electricity generating methods employed in Australia:

- Potential to reuse and recycle component parts.
- Short energy payback time in comparison to the life span of the project.
- CO_2 emissions generated per kilowatt hour of energy produced.

7.6.2 Potential impacts

Construction and decommissioning

Resource use

Various resources would be required to construct the proposed solar plant and associated infrastructure, including the following:

- Construction materials, including metals, glass, plastics.
- Masonry products, including concrete for slabs, hardstand areas and building elements.
- Materials such as fuels and lubricants associated with operation of machinery and motor vehicles.
- Gravel, if required, for the main access track only (up to approximately 960 m^3 based on approximate road width, length and gravel depth measurements of 6 metres, 1.6 kilometres and 0.1 metres, respectively).

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the above materials are not currently limited or restricted. In the volumes required, the proposal is unlikely to place significant pressure on the availability of local or regional resources.

Water would be required during construction for activities including watering of roads and in the site office and amenities. Water use is considered in section 7.9.

While tellurium, one of the key semiconductor components of the proposed modules, is a rare metal, First Solar's recycling program is designed to recycle up to 95% of semiconductor material thereby minimising pressure on external supplies of tellurium.

In summary, use of the required resources is considered reasonable in light of energy pay back periods and benefits of offsetting fossil fuel electricity generation.

Waste

Solid waste is one of the major pollutants caused by construction. A number of different construction activities would produce solid wastes, such as:

- Packaging materials.
- Building materials.
- Scrap metal.
- Excess soil.
- Plastic and masonry products.
- Vegetation clearing.

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction and decommissioning phases would be classified as building and demolition waste within the class *general solid waste (non putrescibles)*. Ancillary facilities in the site compound would also produce sanitary wastes classified as *general solid waste (putrescibles)* in accordance with the POEO Act.

During decommissioning, all infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities.

Operation

Electricity production using photovoltaics emits no pollution, produces no greenhouse gases, and uses no finite fossil-fuel resources (US Department of Energy 2004). Only limited amounts of fuels would be required for maintenance vehicles during operation of the solar plant. Operational waste streams would be very low as a result of low maintenance requirements of the solar plant.

Some balance of system electrical components (e.g., inverters, transformers, electrical cabling) would likely need replacement over the proposed life of the solar plant, requiring further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste during plant operations; however, such activities would occur very infrequently and there would be a high potential for recycling or reuse of such waste.

The embedded energy in the solar plant would be 'paid back' within a relatively short time frame once the solar plant is commissioned – in the order of 1 year according to research cited in section 7.6.1, and less than 1 year according to First Solar (2012e).

7.6.3 Mitigation

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Further information about resource use and waste generation measures is provided in section 8.2.

7.7 FIRE AND BUSH FIRE ISSUES AND IMPACTS

Bush fire risk relates to fuel quantity and type, topography and weather patterns, as well as ignition and combustion risks inherent in certain infrastructure (such as transmission lines and substations). Bush fire presents a threat to human life and assets and can deliver adverse ecological impacts.

The NSW Rural Fire Service (RFS) identified issues relating to bush fire as important during development of the DGRs for this proposal (refer Table 4-1). Specific issues raised by the RFS are addressed in this section and related mitigation measures in section 8.2.

7.7.1 Background

The site is relatively flat and largely cleared of overstorey vegetation. The site has been cropped and understorey fuel load varies but is considered relatively low. Treed corridors exist along the site boundaries and also along paddock boundaries within the site, although these are mostly narrow and sparse. The widest corridor is approximately 100 metres wide and located on the western boundary of the site. At a local level (within 5 kilometres), the treed corridors are considered to have low levels of connectivity to other treed areas and would have low potential to spread a bush fire.

The transmission line would be located parallel to the western tree corridor. It would also cross a larger treed corridor (approximately 330 metres in width) south of the Barrier Highway. This corridor has good east-west connectivity over a distance of approximately 15 kilometres.

The local bush fire season generally occurs between October and March; the local area experiences cold winters and hot summers, with summer predominant rainfall. North-westerly winds are common with high daytime temperatures and low relative humidity, which increases bush fire risk. Lightning storms are frequent during the bush fire season. Historically, the North West Bush Fire Management Committee (NWBMC) area has experienced 20 bush fires on average per year, including approximately one major fire

per year. The North West Bush Fire Risk Management Plan (NWBRMP) (NWBMC 2009) identifies the main ignition sources as electrical storms, lightning, ignition from farming machinery and arson.

The NWBRMP, prepared in accordance with the *Rural Fires Act 1997*, sets out a five year strategic management plan to reduce bush fire risk on private and public land within several areas of north west NSW including the Bogan LGA. The proposal area does not lie within any of the bush fire management zones identified in this plan. Furthermore, according to mapping undertaken by Cobar Bush Fire Management Committee (2011), the proposal area is not located within any bush fire management zones.

The proposal includes two infrastructure components, transmission lines and a substation, with a risk of exacerbating or causing fire.

The nearest Rural Fire Service station is located in the Nyngan township, at 65 Cobar Street.

7.7.2 Potential impacts

Construction and decommissioning

Activities associated with project construction that may cause or increase the risk of bush fire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol powered tools.
- Welding and soldering activities.
- Operating a petrol, LPG or diesel powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.

Considering the sparse vegetation cover over the proposed site and other factors discussed above, it is considered unlikely that project would pose a significant bush fire risk. Site access would be formalised at the beginning of the construction stage during civil works, which would increase the ability to access and suppress any fire onsite or on adjoining sites.

The bush fire hazard associated with the activities listed above is considered highly manageable. Risks would be minimised through the implementation of fire and bush fire mitigation measures outlined in section 8.2.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction and operation activities (below), any bush fire risk associated with decommissioning of the project would be highly manageable.

Operation

As well as the activities listed above, which also apply to operation, repairs and maintenance activities during project operation could increase bush fire risk.

The substation transformer would contain transformer oil for the purpose of cooling and insulation. The facility would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facility would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear. The substation would be surrounded a security fence and a gravel and concrete area free of vegetation to prevent the spread of fire from the

substation and reduce the impact of bush fire on the structure. Transformer oil would be changed at appropriate intervals by qualified staff to minimise the potential for fire caused by contaminated oil.

Asset protection zones would also be maintained around buildings at the site.

It is expected that Essential Energy would maintain the substation and transmission line infrastructure to minimise bush fire ignition risks.

The PV modules proposed for use at the Nyngan Solar Plant contain cadmium, which is a toxic chemical. In the unlikely event of a fire at the plant, there could be concerns about inhalation of toxic fumes and vapours if photovoltaic materials decompose or vaporise. However, Fthenakis *et al.* (2004) showed that the glass sheets on either side of the CdTe material fuse together during a fire, trapping the cadmium material between them, and the actual cadmium loss prior to sealing during fires would be insignificant (<0.04% of the modules cadmium content). Given the potential for community sensitivity in relation to toxic substances, planning for the unlikely event of fire would include precautionary measures such as post-fire sampling, where appropriate, to confirm any emissions of cadmium and lead are insignificant.

Bush fire risks during operation of the solar plant and connection infrastructure is considered highly manageable.

7.7.3 Mitigation

Fire risks would be addressed as part of the project through the development and implementation of a Bush Fire Management Plan, covering construction and operational phases, as detailed in section 8.2.

7.8 HISTORIC HERITAGE

7.8.1 Background

A desktop study was undertaken to identify any historic heritage (non-aboriginal) items or places in proximity to the study area, with a particular focus on the proposed works site (solar plant site and transmission line). Several heritage databases were searched on 2 August 2012 as part of this assessment. These included:

- The NSW State Heritage Inventory (includes items on the State Heritage Register and items listed by state agencies and local government) to identify any items currently listed within or adjacent to the proposal site. The area searched was the Bogan Shire LGA.
- The Australian Heritage Database (includes items on the National and Commonwealth Heritage Lists) to identify any items that are currently listed within or adjacent to the proposal site.
- The heritage schedule of the Bogan Local Environment Plan (LEP) 2011 for locally listed heritage items that are within or adjacent to the proposal site. This is the current LEP for the proposal site.

Results

The results of the heritage searches listed above indicate that no known historic items or places occur on the site. The results of the heritage searches are illustrated in Table 7-8.

Table 7-8 Summary of heritage listings in the Bogan LGA.

Name of register	Number of listings
World Heritage	0
National Heritage List	0
Commonwealth heritage List	0
NSW State Heritage Register	2
NSW State Agency Heritage Register (section 170)	2
Bogan Local Environment Plan (LEP) 2011	4

State Heritage Register

A search of the NSW State Heritage Register within the Bogan Shire LGA indicated two listings. These included:

- Chinese Graves and Burner at Nyngan Cemetery (Cemetery Road, Nyngan)
- Nyngan Court House (Cobar Street, Nyngan)

These items are listed by the Heritage Council under the NSW *Heritage Act 1977***.**

NSW State Agency Heritage Register (section 170)

A search of the NSW State Agency Heritage Register within the Bogan Shire LGA indicated two listings. These included:

- Nyngan Courthouse (Cobar Street, Nyngan)
- Nyngan Railway Precinct (Pangee Street, Nyngan)

These items are listed by Local Councils & Shires and State Government Agencies.

Local Heritage Schedule Listings

Similar to the National and State listings, heritage significance may be attributed to an item on social, architectural, natural, scientific, archaeological, aesthetic, historic or cultural grounds. Four items are listed on the LEP. These include the two items listed above under the State Heritage Register as having state significance, and the following two items of local significance:

- Nyngan Railway Station (Pangee Street, Nyngan)
- Overhead footbridge and goods shed (Pangee Street, Nyngan)

Both of these items are within the Nyngan township.

Unlisted Heritage Items

Although no listed items were identified within the site, it is acknowledged that there may be unlisted items of historic significance on the subject site. No additional potential heritage items were identified within the proposal site during the site inspection for Aboriginal and Historic heritage.

7.8.2 Potential impacts

Construction and decommissioning

A number of heritage items were identified from the desktop study, outlined above. These items are located within the township of Nyngan, well outside of the study area.

The transport of heavy vehicles on roads passing near identified heritage items may increase levels of dust and vibration. Given the site's distance from the identified heritage items (approximately 10 kilometres), the capacity of haulage routes to handle large loads and the temporary nature of works, dust and vibration generated from heavy trucks is not expected to be an issue.

The proposal is not considered likely to have a significant impact in accordance with the NSW *Heritage Act 1977*, the EP&A Act, or the Commonwealth EPBC Act, in terms of heritage. No impacts are considered likely during the construction or decommissioning phases. No heritage approvals are required.

Operation

Potential for impacts to heritage items during operational activities would be substantially less than for construction and decommissioning activities. No impacts are considered likely during the operational phase. No heritage approvals are required.

7.8.3 Mitigation

A protocol for unexpected finds would be developed for the construction phase, as detailed in section 8.2.

7.9 SOIL AND WATER (INCLUDES WATER USE)

Risks to soil include soil loss through erosion, soil compaction or contamination. Topsoils are critical for agriculture and cannot be easily replaced within a human time scale. Adverse soil impacts can also have ecological impacts, affecting habitat condition, water quality and riparian ecosystems. Risks to soils are influenced by landscape position, slope, soil type, hydrology and land use.

The NSW Office of Water, Bogan Shire Council and the EPA identified issues relating to soil and water management as important during development of the DGRs for this proposal (refer Table 4-1). Specific issues raised by these agencies are addressed in this section.

7.9.1 Background

Soils and landforms

The topography of the proposal area is flat. It lies on the border of two geological regions, the Great Artesian Basin and the Lachlan Fold Belt (DPI 2012). The Great Artesian Basin spans 22% of Australia (1.7 million square kilometres), covering a large area of Queensland and also including parts of NSW, South Australia and the Northern Territory (DSEWPC 2011b). The Lachlan Fold Belt is located across NSW and Victoria and is characterised by deformed, Palaeozoic deep and shallow marine sedimentary rocks, cherts and mafic volcanic rocks (Gray 1997).

Soil at the proposal area is mapped as the Summervale soil landscape (DECC 2006). The Summervale landscape is part of the colluvial slopes and plains and flow lines associated with the Girilambone Beds to the northwest of Nyngan. They contain red and brown chromosols, red kandosols and sodosols. The soil

type is also characterised by unconsolidated red-brown silt, with minor clay and sand and moderately deep to deep red earth with a sandy topsoil (Watkins 1996). This soil type occurs on gentle slopes with intermediate drainage patterns and includes smaller tributary valley fills.

The NSW Natural Resources Atlas (NR Atlas) indicates the soils are relatively stable and have some resilience to disturbance. Rural land capability mapping indicates that the site is not subject to severe limitations, and is generally suitable for cultivation (NSW Government 2012c). NR Atlas searches did not show any occurrences of Acid Sulphate Soil (ASS), dryland salinity or high erodibility/vulnerable land. Similarly, the site is mapped as Extremely Low Probability/Very Low Confidence for ASS on the Australian Collaborative Rangelands Information System (DSEWPC 2012a). Little evidence of soil erosion was observed during the site visit.

A search of the Office of Environment and Heritage contaminated land public record (OEH 2012a) was undertaken for contaminated sites within the Bogan Shire LGA on 18 July 2012. There were no records returned. The online *List of NSW contaminated sites notified to EPA* (OEH 2012b) was also searched on 17 October 2012. Three sites were found in the Nyngan area, however all three were service station sites located within the Nyngan township. There is a low risk that contamination associated with agricultural activities (e.g., pesticides) could be present on the site.

Water

The proposal site is located in an area subject to the following water sharing plans:

- Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources
- Draft Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources.

Any requirement for additional groundwater or surface water entitlement would be obtained through purchase and trade in accordance with these plans.

There is an existing 1.2 megalitre (ML) dam at the proposed site and an existing 2 ML dam at an adjacent parcel (Lot 2 DP751328). These dams are currently used for watering of livestock, and could potentially be used for water supply and/or storage for use in dust suppression during project construction. These dams are shown on Figure 6-2.

Local bores are present in the area (refer Figure 6-3) but are not proposed for use in the project. No new bores are proposed.

The property is currently served by a “minor consumer” connection to the Cobar Water pipeline which is located to the south of the Barrier Highway.

7.9.2 Potential impacts

Construction and decommissioning

Soil impacts

General construction activities, such as excavation and trenching, have the greatest potential to cause soil erosion and subsequent sedimentation at the site. Soil erosion could potentially occur when excavating footings for the substation and office building or when excavating trenches for underground cables. However, given the nature of the project and the relatively flat topography, large scale bulk earth works would not be required.

Construction of internal tracks would disturb soils. Soil compaction would occur as hardstands and tracks are created, which would reduce soil permeability thereby increasing run off and the potential for concentrated flows. Trenches excavated for underground cabling would remove vegetation cover and disturb soils, potentially decreasing their stability and increasing susceptibility to erosion.

Driving of steel posts supporting the PV modules as well as installation of power poles would compact and disturb soils. However, the areas of disturbance would be small and sparsely distributed, and the surrounding groundcover would be retained.

Dust may be generated as a result of the project site construction and traffic activities. Dust would be minimised using the following means:

- A water cart (truck) would be utilised routinely, wetting all access roads and exposed dusty surfaces as appropriate to the conditions of the project site.
- Stockpiled topsoil and other materials that exhibit significant dust lift off would be wet down routinely, as required.
- Stabilising techniques and/or environmentally acceptable dust palliatives would be utilised if the wetting down of surfaces prove to be ineffective.

Erosion and sedimentation impacts associated with soil disturbance from the above activities can be minimised by undertaking such works in accordance with provisions of the Managing Urban Stormwater: Soils and Construction series, in particular:

- Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition (Landcom 2004), known as 'the Blue Book'.
- Volume 2A Installation of Services (DECC 2008a).
- Volume 2C Unsealed Roads (DECC 2008b).

Additionally, impacts to local water quality can be minimised by ensuring erosion and sediment control plans include measures to ensure ANZECC (2000) water quality criteria are met prior to discharge of water offsite.

The use of fuels and other chemicals on site pose a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and herbicides.

It is possible that contamination associated with past agricultural activities (e.g., pesticides) could be present on the site, however, given no contaminated sites are recorded on or adjacent to the proposed development, it is unlikely that significant contamination exists at the proposed site. Furthermore, construction activities would not significantly disturb soil or groundwater at the site. If contamination is identified during site construction, it would be managed in accordance with a Construction Environmental Management Plan (CEMP).

Water use

Water usage during construction would be up to 150,000 litres per day, mainly for dust suppression on unsealed roads. This volume is likely to vary dramatically depending on temperature and rainfall. No concrete batching would be undertaken onsite.

Assuming 150,000 litres per day (0.15 ML/day) for 15 months (June 2014 to September 2015), a total of approximately 68 ML would be required.

Several options have been identified for supplying the water required:

- Existing dam located on the solar plant site to collect and store surface water runoff from the site.
- Connection to the Cobar Water pipeline under a new "Major User" connection.
- Trucking water from Bogan Shire Council Depot

Under normal climatic conditions, and when used for stock watering only, the existing dam would be unlikely to go dry. However, under extended drought conditions, and considering the volume of water that may be required for dust control during construction, it is possible that the dam could go dry.

The proponent has therefore consulted with the Cobar Water Board (CWB) regarding access to a 'high security' water supply from the Cobar Water pipeline. The CWB has confirmed that supply of water to the site is possible under a new "Major User" connection. The proponent would be required to purchase or lease water from the temporary water market, and then enter into a commercial arrangement with CWB to secure the water volumes required (including volumes required to cover supply system losses as advised by CWB). Capital contributions to the Cobar Water supply system, connection costs and water usage charges would apply. A standpipe would be constructed adjacent to the Cobar Water pipeline for use in filling water carts.

The proponent has also consulted with the Bogan Shire Council regarding access to the standpipe located at the Council Depot in the Nyngan township. The Council has confirmed that water is available from the standpipe and could be used during project construction.

In summary, there are several options for securing water for dust control during construction and the preferred method (or combination of methods) would be finalised closer to construction. In the event on-site supply is insufficient during construction, water access can be secured through commercial arrangements with local water supply authorities.

Based on the type of construction proposed and the relatively flat and stable landforms, the above soil and water impacts are considered to be of low risk and highly manageable.

Impacts on soil during decommissioning would be similar to those during construction. Removal of pile driven posts and other infrastructure would cause some disturbance to soil. All areas of soil disturbed during decommissioning would be rehabilitated. Site rehabilitation is considered in more detail in section 6.2. Risks to soil and water during decommissioning are considered highly manageable.

Operation

Soil impacts

Minimal operational impacts to soils would occur. Maintenance activities and vehicles would be largely confined to the formalised access tracks. There would remain a minor risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides).

Transformer oil would be used in the substation for the purpose of cooling and insulation. The transformer would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facility would be regularly inspected and maintained.

The potential for wind erosion (dust generation) during regular plant operation would be low given the ability to stabilise soils exposed during construction. For example, areas that were temporarily used during construction (e.g., laydown and construction parking areas) would be restored back to original condition or re-vegetated with native plants. Additionally, areas that were not hard packed but had been disturbed in some form would be treated with environmentally acceptable dust palliatives and/or

vegetated (e.g., by means of hydro seeding) with seeds native to the area (where this occurs in native vegetation) or suitable exotic species, where vegetation is exotic (i.e., pasture grasses).

Concentrated runoff from the PV modules could lead to increased soil erosion below the modules during significant rain events. Retaining vegetation cover would assist in reducing potential for erosion from rainfall run-off.

Flood flows past array posts may generate localised turbulence and soil erosion, although in view of the expected low flow velocity and retained vegetation cover, these impacts are expected to be minor.

Water use

Water use volumes during operation would be minimal with requirements limited to amenities for 2 people at the operations and maintenance building, for 6 days per week 8 hours per day.

The Department of Environment and Heritage (2006) identifies a water consumption benchmark of 9.3 m^3 per person per annum and a best practice target of 6.4 m^3 per person per annum in office and public buildings. AGL would aim to meet the best practice target, requiring a total operating water volume of approximately 12.8 m^3, or 12.8 kilolitres (kL) per annum.

Based on a recommended 8 glasses (2 litres) of drinking water per person per day, approximately 1.25 kL of potable water would be needed per annum. Drinking water for site staff would be supplied by bottled water.

The remaining 11.55 kL of non-potable water required would be supplied from rainwater tanks and, if required, the onsite dam. Given a minimum roof area of 75m^2 for the Operations and Maintenance Building (O&M building), an average rainfall of 446.6mm (BOM 2013), and a run-off coefficient of 0.9, approximately 30.15 kL of rainwater could be harvested from the O&M building per annum. This would be more than sufficient to meet the project's non-potable requirements under both the benchmark and best practice water consumption scenarios.

If required, non-potable water from the dam would likely be pumped into a tank next to the operations and maintenance building. As observed above, under normal climatic conditions, and when used for stock watering only, the existing dam would be unlikely to go dry. Minor volumes to supplement rainwater collection are therefore considered likely to be available, should the need arise.

In addition, the Cobar Water Board has confirmed that the proponent may establish a connection to the Cobar Water pipeline for ongoing supply of water to the site.

The PV modules would not be washed and water would not be required for this purpose.

Table 7-9 Summary of operational water requirements and availability

Water quality	Annual operational water requirement (kL)	Potential sources	Annual availability
Potable (drinking)	1.25	Bottled water	Available as required - commercial supply
Non-potable	11.55	O&M building rainfall collection	30.15 kL - on average
		On-site dam	Minor volumes to supplement rainwater, if required.
		Cobar Water pipeline	Up to 3 ML via a commercial 'minor consumer' connection.

Operational risks to soil and water resources are considered highly manageable.

7.9.3 Mitigation

Activities with potential for adverse soil and water impacts would be managed through the development and implementation of site-specific sediment control plans and spill controls, as detailed in section 8.2.

If water is required from the local water supplies, access would be obtained in consultation with local authorities, as set out in section 8.2.

7.10 CUMULATIVE IMPACTS

7.10.1 Background

Cumulative impacts, for the purpose of this assessment, relate to the combined potential effects of different impact types of the proposal (i.e., construction noise combined with dust or visual impact) as well as the potential interaction with other proposals in the local area (e.g., the combined effects of the proposal coinciding with other utility works). Cumulative impacts can occur concurrently or sequentially.

7.10.2 Potential impacts

Construction and decommissioning

The key cumulative impacts of construction are considered to relate to biodiversity impacts, traffic impacts, water use, and adverse amenity impacts (dust, noise, visual).

Key adverse cumulative impacts relating to biodiversity include the clearing of vegetation and removal of habitat, particularly for threatened species (such as the Grey-crowned Babbler). The landscape in which the proposal is located has already been highly modified for agricultural activities. Remnant native vegetation is limited and fragmented and the proposal would contribute to these adverse impacts. Specific to threatened species, the proposal would remove approximately 6 hectares of known Grey-crowned Babbler habitat. However, the Grey-crowned Babbler is relatively common in the area. The remaining habitat surrounding the site would continue to provide optimal foraging and breeding habitat for the Grey-crowned Babbler, and connectivity would be maintained. As such, the cumulative impact to threatened species is considered low.

Construction traffic impacts include:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (where traffic is on unsealed roads) may adversely affect nearby receivers.
- Disruption to existing services.

These impacts would largely be temporary and are manageable with the implementation of safeguards (refer to section 7.5). Cumulative traffic impacts may also occur if other large-scale construction projects are instigated in the Nyngan area during the same period of construction as the proposed Nyngan Solar Plant. DoPI's major projects register (DoPI 2012a) identifies that approval has been granted for development of a utility scale solar farm south east of Nyngan, and DGRs have been granted for a proposed mine (the Nyngan Scandium Project) located south of Barrier Highway approximately

4.7 kilometres west of the southern extent of the proposed transmission line. It is not known if, or when, these projects would commence construction. The proposed solar farm south east of Nyngan would not use the same construction traffic access routes from Nyngan as this proposal, however there is potential for the proposed mine's construction traffic to also use the Barrier Highway, as it too is located west of Nyngan. If the Nyngan Scandium Project receives development approval, and construction/operation by EMC Metals Corp was to occur during construction of the Nyngan Solar Plant, they would be consulted to determine if construction traffic for the respective proposals could be scheduled to minimise cumulative impacts to third parties.

The two solar developments' respective haulage routes would both use the Mitchell Highway from Dubbo to Nyngan. The Mitchell Highway is considered likely to have suitable capacity to cater for concurrent construction of the two projects if required, as it is a key freight route in NSW and designated as a route suitable for heavy vehicles, including road trains and 4.6 metre high vehicles (RMS 2012).

Construction water use is discussed in section 7.9. Construction water would be largely sourced onsite, and supplemented from the Council water supply or the Cobar Water Board supply as required. This would not cause increased pressure on other licensed water users. The impact on other water users of the Bogan Shire Council supply and the Cobar Water Board supply is expected to be low.

Cumulative construction noise and visual amenity impacts relate mostly to the transmission line construction. These impacts would be temporary and confined to the construction phase. Considering the location of the site and distance to sensitive receivers, the cumulative effect of these impacts is considered minor.

Cumulative construction impacts are considered to be best managed by managing each component (dust, noise etc.) individually. Cumulative decommissioning impacts would be minor. Cumulative impacts would be managed at the time of decommissioning. Infrastructure developed during construction (e.g., access tracks) would be utilised during decommissioning.

Operation

During operation, potential cumulative impacts would relate to renewable energy generation and agricultural production.

The addition of the Nyngan Solar Plant, along with the Broken Hill Solar Plant also proposed by AGL, would have a positive cumulative impact in terms of reducing greenhouse gas emissions and meeting increasing electricity demand in NSW.

Agricultural production from the proposal site would be affected during the operation of the solar plant. Following decommissioning, the existing forms of agricultural production (grazing and cropping) could resume. Existing land used for grazing and cropping could continue under the proposed transmission line during operation. Sheep grazing could potentially continue within the solar plant area, but would occur at reduced levels of production. A temporary reduction in agricultural production at the proposal site is not expected to have a major impact on the overall agricultural production from the Nyngan area.

7.10.3 Mitigation

Cumulative impacts are best addressed through careful management of individual components, as set out in section 8.2. An additional measure to consult with EMC Metals Corp has been provided to investigate cumulative construction traffic impacts, if this project is approved and construction timing overlaps with construction of the Nyngan Solar Plant.

8 ENVIRONMENTAL MANAGEMENT

8.1 ENVIRONMENTAL FRAMEWORK

The environmental risks associated with the proposed solar plant would be managed by implementing a project-specific suite of mitigation measures detailed in sections 6 and 7 and summarised in section 8.2 of this EIS.

All commitments and environmental safeguards would be managed through the implementation of a Project Environmental Management Plan (EMP), consisting of a Construction Environmental Management Plan (CEMP), an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). These plans would be prepared sequentially, prior to each stage of works.

These plans would detail the environmental management responsibilities of specific staff roles, reporting requirements, monitoring requirements, environmental targets and objectives, auditing and review timetables, emergency responses, induction and training, complaint response procedures and adaptive management mechanisms to encourage continuous improvement.

8.2 MITIGATION MEASURES

Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Construction (C), Operation, (O), Decommissioning (D)

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
	Biodiversity						
1.	A supplementary survey during spring (early October) prior to the finalisation of the transmission line design would be conducted to confirm if threatened flora species including the Red-darling Pea and Pine Donkey Orchid inhabit the higher quality woodland vegetation south of the Barrier Highway. If these species are identified in areas proposed for impact, transmission infrastructure would be microsited with input from an ecologist to ensure a significant impact is avoided. If unavoidable, all areas of suitable habitat within the easement would be included as additional permanent impact areas and would be added to the total area required to be offset.				X		
2.	Grey-crowned Babbler nest sites identified in Figure 4-7 of the Biodiversity Assessment would be protected from impact during infrastructure siting and design process.				X		
3.	Pre-clearance surveys would be conducted prior to felling hollow-bearing trees.	X			X		
4.	Works would avoid impacts to mature trees that are to be retained. Tree protection standards would comply with Australian standard AS 4970-2009 Protection of trees on development sites (Standards Australia, 2009). Wherever practicable, excavations and vehicle/machinery movements would occur outside the canopy dripline of large eucalypts.	X			X		
5.	Removal of the east-west strip of vegetation must be conducted outside of the breeding season of the Grey-crowned Babbler (June to February) unless the nests have been confirmed to be inactive.	X			X		

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
6.	Restoration of habitat: Hollows from felled hollow-bearing trees would be salvaged and placed in retained trees or on poles in adjacent habitat. For each hollow salvaged, a nest box would also be installed to offset the loss of habitat. Where it is not deemed to be a fire hazard, timber from cleared trees (coarse woody debris – CWD – including logs) is to be relocated into areas of adjacent woodland to provide foraging habitat for species such as Grey-crowned Babblers and other ground dwelling fauna. CWD would be scattered evenly across the relocation areas, not piled or windrowed. Cleared native vegetation not likely to provide habitat would be mulched rather than burned.	X			X		
7.	Within areas of native vegetation, existing tracks would be used wherever possible to avoid compaction and/or disturbance.	X			X		
8.	Traffic management measures would be incorporated into the construction and operation phase and would address traffic flow, vehicle speed and vehicle numbers entering and leaving the site. This would aim to prevent collisions with fauna utilising the site, particularly Grey-crowned Babblers.	X			X		
9.	Excavated topsoil would be stored separately from subsoil and replaced in a manner that replicates the original profile as closely as possible to assist rapid revegetation.	X			X		
10.	Site stabilisation, rehabilitation and revegetation would be undertaken progressively during works, to ensure that soils are stabilised as soon as practical. This would minimise weed infestation, sedimentation and erosion, which degrade habitat.	X			X		
11.	Disturbed areas would be identified and used preferentially for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and the deposition and retrieval of spoil whenever practicable, to minimise the footprint of the development on intact native-dominated areas.	X			X		
12.	A weed management plan would be developed for the site, guided by the measures set out in the Biodiversity Assessment.	X			X		
13.	Perimeter security fencing will feature heavy duty fabric to increase visibility to fast flying parrots.	X					
14.	Where trenches are to be excavated and backfilled in well vegetated native areas, whole sods would be removed, stored in moist, shaded conditions and replaced following the works. Sod storage time would be minimised and sods would be replaced in a manner that maximises the chances of re-establishment and soil stabilisation.	X					
15.	If the dam in the south of the solar plant site is removed during the works, an alternative watering point would be established to compensate for its loss to maintain similar habitat resources for native fauna.	X					
16.	Trenches would be left open for the least time practical and would be inspected for trapped fauna prior to back filling. Any trench sections left open overnight would be inspected early in the morning and any trapped fauna removed.	X					
17.	A groundcover management plan would be developed, as outlined in the Biodiversity Assessment.	X	X				
18.	The space between the PV array rows would be kept clear to enable access by vehicles for ongoing weed control, and pasture renovation, if required.		X				
19.	Nest boxes and salvaged hollows remounted during the construction phase would be routinely inspected to check the integrity of the structures and remedy them if required.		X			X	

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
20.	Areas of native vegetation that were impacted by the proposal would be rehabilitated to a level that demonstrates an increase in the environmental values of the site compared to its pre-operational state. A rehabilitation plan would be prepared that includes ongoing monitoring to ensure the rehabilitation is successful for the long-term.			X			
21.	An Offset Plan would be developed with input from OEH and the CMA and according to the strategy provided in Appendix G of the Biodiversity Assessment. It would be finalised prior to any construction impacts, as outlined in the Biodiversity Assessment. The objective of offsetting is to ensure that an overall 'maintain or improve' outcome is met for the project; where impacts cannot be avoided, or sufficiently minimised, the residual impact would be offset in perpetuity.	X			X		
22.	Prior to finalising the Offset Site boundaries, the proponent would validate the area impacted by construction to ensure that the actual, not estimated, impacted area is offset.	X			X		
23.	The offset site management actions and their outcomes would be reported every two years to the Department of Planning and Infrastructure for the duration of the project (up to 30 years) to demonstrate that a 'maintain or improve' outcome has been met.		X			X	
	Aboriginal heritage						
24.	If human skeletal remains are found during the activity, work in the area of the remains would stop immediately, the area would be secured to prevent unauthorised access and the NSW Police and OEH would be contacted.	X		X	X		X
	Hydrology (surface and groundwater)						
25.	The substation and office building would be designed to accommodate a 1:100 year flood and be located in the south-west of the site, outside the inundation zone (Figure 6-1).	X					
	Noise amenity						
26.	The employee and contractor induction would inform all site personnel about noise management measures, construction hours and nearest sensitive receivers.	X			X		
27.	All employees are responsible for managing noise from their work activities and working in a manner to reduce noise.	X		X	X		X
28.	Works are to be carried out during standard work hours (i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities. For works outside standard hours, inform affected residents and other sensitive land use occupants between 5 and 14 days before commencement.	X		X	X		X
29.	Where reasonable and feasible, noisy activity would be carried out in the least sensitive time periods (to be determined through community consultation).	X		X	X		X
30.	A Construction Noise Management Plan would be prepared as part of the Construction Environmental Management Plan. It would include provision for noise monitoring to be undertaken in the event a noise complaint is received to verify if target noise levels are exceeded at that receiver. If so, additional measures would be developed in consultation with the complainant.	X			X		

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
31.	Community consultation would be ongoing for residences within close proximity to the works. The information would include details of: • The proposed works • The duration and nature of the works during construction • What works are expected to be noisy • What is being done to minimise noise • When respite periods would occur • Regular updates on progress of works.	X			X		
32.	Ensure equipment is operated and maintained in accordance with the manufacturer's instructions including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components, repair of leakages in compressed air lines and shutting down equipment not in use.	X	X	X	X	X	X
33.	Avoid the operation of noisy equipment near noise-sensitive areas and where possible, loading and unloading would be conducted away from sensitive areas.	X	X	X	X	X	X
34.	Position plant and equipment on site in a position that provides the most acoustic shielding from buildings and topography. Plant known to emit noise in one direction would be orientated where practicable to screen the emissions.	X	X	X	X	X	X
35.	Where feasible and reasonable install multi-frequency alarms and smart alarms on vehicles, taking into account the requirements of the Work Health and Safety legislation.	X		X	X		X
36.	Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).	X	X	X	X	X	X
	Visual amenity						
37.	To break up views of infrastructure, screening vegetation would be planted or allowed to regenerate in areas identified in Figure 6.1 of the Visual Impact Assessment. Maintenance requirements of the planting would be considered within the operational management plan to ensure that plants are watered as required and that dead plants are replaced.	X	X		X	X	
38.	Clearing of vegetation minimised. In particular, the tree lines on the western, northern and eastern boundaries of the site retained intact and the transmission line route placed to allow this to occur.	X			X		
39.	All areas disturbed by the construction of the proposed transmission line and solar plant would be allowed to naturally regenerate and be monitored to ensure that regeneration has occurred. Where natural regeneration is unsuccessful, revegetation would be undertaken.	X			X		
40.	The colour of above ground structures, including the construction site offices, would be sympathetic to the landscape character of the site to minimise visual contrast.	X					
41.	The following principles would be considered regarding placement of poles near the Barrier Highway crossing to reduce their visual impact: • setting poles as far back as possible from the road where the transmission line crosses the road • arranging the poles so that the transmission line crosses roads at right angles • locating poles where they can be screened from view by existing vegetation (and adding in screening vegetation where needed).				X		

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
	Air quality						
42.	Air quality impacts would be addressed via the development of: • Protocols to guide vehicle and construction equipment use, to minimise emissions. • Protocols to minimise and treat dust (water carts or similar).	X		X	X		X
	Health and safety						
43.	The substation and transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposure to EMFs.	X			X		
44.	Design of electrical infrastructure would minimise EMFs.	X			X		
45.	Fencing around the substation would be maintained to limit public access.		X				
	Land use impacts and mineral resources						
46.	Consultation with neighbouring landholders regarding any temporary impacts to access or risks to livestock. Additional specific mitigation may be required such as: • Additional fencing to protect livestock from collision risks • Vehicle speed restrictions on access roads.	X			X		
47.	Consultation with mineral stakeholders would be undertaken to inform them of the timing of works and final infrastructure layout.	X			X		
	Socioeconomic and community wellbeing						
48.	A Community Consultation Plan would be developed to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc) • Protocols to respond to any complaints received.	X	X	X	X	X	X
49.	Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	X			X		
50.	Liaise with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	X			X		
	Traffic, transport and road safety						
51.	A Traffic Management Plan would be developed for construction traffic with input from the road authority, including but not limited to: • Assessment of road condition prior to construction on all local roads that would be utilised • Intersection upgrade for site access off the Barrier Hwy • Carpooling/shuttle bus arrangements to minimise vehicle numbers • Scheduling of deliveries • Community consultation regarding traffic impacts where sensitive receiver exceedances are predicted • Consideration of bus schedules – i.e., Countrylink and school • Traffic controls (speed limits, signage etc) • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts • Provide a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures • Reinstatement of pre-existing conditions, where required.	X			X		

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
52.	A Haulage Plan would be developed with input from the roads authority, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure • Scheduling of deliveries of major components to minimise safety risks (on other local traffic including buses) • Community consultation regarding impacts to bus routes • Traffic controls (signage and speed restrictions etc.).	X		X	X		X
	Resource use and waste management						
53.	A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy • Quantification and classification of all waste streams • Provision for recycling onsite • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant) • Provision of disposal at facilities permitted to accept the waste.	X			X		
54.	Excess subsoil would be removed from the site and disposed of at an appropriate fill storage site.	X		X	X		X
55.	Excess topsoil would be retained and used in site rehabilitation.	X		X	X		X
	Fire and bush fire						
56.	Develop a Bush Fire Management Plan with input from the RFS to include but not be limited to: • Management of activities with a risk of fire ignition • Management of fuel loads onsite • Storage and maintenance of fire fighting equipment, including siting and provision of adequate water supplies for bush fire suppression • The below requirements of *Planning for Bush Fire Protection 2006* - o Identifying asset protection zones o Providing adequate egress/access to the site (s4.1.3) o Emergency evacuation measures (s4.2.7) • Operational procedures relating to mitigation and suppression of bush fire relevant to the solar plant • Post-fire clean up procedures, including the need for sampling for emissions of cadmium and lead, where appropriate.	X	X		X	X	
	Historic heritage						
57.	Should an item of historic heritage be identified, the Heritage Branch (Office of Environment and Heritage) would be contacted prior to further works being carried out in the vicinity.	X			X		
	Soil and water (includes water use)						
58.	Site specific Erosion and Sediment Control Plans would be prepared, implemented and monitored during the project, in accordance with Landcom (2004), to minimise soil and water impacts. These plans would include provisions to ensure any discharge of water from the site is managed to ensure ANZECC (2000) water quality criteria are met and traffic generated soil erosion is minimised.	X		X	X		X

No.	Mitigation measures	Solar plant			Transmission line		
		C	O	D	C	O	D
59.	A Spill Response Plan would be developed to: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures). • Prevent contaminants affecting adjacent pasture and dams.	X	X	X	X	X	X
60.	If water is required from the local water supply authorities, access would be obtained in consultation with: • Cobar Water Board, for water from the Cobar Water pipeline • Bogan Shire Council, for water from the local council supply	X			X		
61.	Dust suppression activities would be undertaken, including: <u>During construction and decommissioning</u> • A water cart (truck) would be utilised routinely, wetting all access roads and exposed dusty surfaces as appropriate to the conditions of the project site. • Stockpiled topsoil and other materials that exhibit significant dust lift off would be wet down routinely and as appropriate. • Stabilising techniques and/or environmentally acceptable dust palliatives will be utilised if the wetting down of surfaces prove to be ineffective. <u>During operation</u> • Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored back to original condition or re-vegetated with native plants. • Areas that may not have been hard packed but have been disturbed in some form would be treated with environmentally acceptable dust palliatives and / or vegetated (e.g. by means of hydro seeding) with seeds native to the area.	X	X	X	X	X	X
	Cumulative impacts						
62.	Should the Nyngan Scandium Project receive development approval, EMC Metals Corp would be consulted by the Nyngan Solar Plant proponent to determine if construction traffic for the respective proposals could be scheduled to minimise cumulative impacts to third parties.	X			X		

9 CONCLUSION

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Nyngan Solar Plant, in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP).

The proposal would comply with relevant Commonwealth, State and local planning requirements.

The investigation of key risks concluded:

- Biodiversity impacts
    - Constraints mapping has been undertaken to avoid impacts where possible, on high conservation value areas.
    - Impacts to threatened entities can be managed to avoid a significant impact. This includes retaining the north-south corridor of native trees in the centre of the site; the number of solar modules has been reduced to retain these trees.
    - Management prescriptions have been developed to minimise risks to biodiversity, including pre-clearance surveys, weed controls, collision reduction design measures, groundcover management, site rehabilitation.
    - Clearing of native vegetation would be offset in perpetuity. Provision would be made in the offsets for the protection of Grey-Crowned Babbler habitat. Hollows would also be offset.
- Aboriginal heritage
    - Considering the results of field investigations and the predictive model of site (i.e., highly disturbed from cultivation), the site is considered to be of low scientific significance and further investigation is not considered to be necessary.
    - In respect of Aboriginal community consultation, no comments were received during the 28 day period for review of the draft ACHA report.
- Hydrology, including flooding
    - The solar plant site is not subject to flooding from Whitbarrow Creek above a depth of 0.3 metres in a 100 year ARI event.
    - Infrastructure has been sited in response to the flood study.
    - Groundwater (locally, at a depth of 30-60m) and Groundwater Dependent Ecosystems would not be impacted by the proposal.
- Noise
    - There are few noise-sensitive receivers within the vicinity of the proposal site.
    - Background noise logging and conservative modelling identified compliance with all relevant criteria (construction and operational).
    - Predictions allow for a worst case scenario and it is anticipated that during typical construction works the level of noise at any receiver will actually achieve a larger margin of compliance.
- Visual amenity
    - There appears to be little concern in the local community about the visual impacts of the proposed development.
    - Glare due to reflection is expected to be minimal and comparable to glass facades.

- Sixteen view points were assessed separately, and all were considered to have low impact significance.

Impact avoidance and minimisation measures have been incorporated into the design of the proposal and accompany this proposal as project-specific mitigation measures. These measures relate to the key issues above, as well as additional issues investigated as part of this EIS. They are considered practical and achievable by the proponent.

This EIS demonstrates that, with the effective implementation of these measures:

Potential impacts are manageable and would not result in a significant impact to the environment, including any Matters of National Environmental Significance.

Key benefits of the proposal include:

- Reduction in greenhouse gas emissions and a move towards cleaner electricity generation.
- Supply of renewable energy which would assist the Commonwealth Government to reach the Renewable Energy Target of 20 per cent by 2020, and the NSW Government to achieve the objectives set out in the *Draft NSW Renewable Energy Action Plan*.
- Provision of additional electricity generation and supply into the Australian grid.
- Social and economic benefits through the provision of direct and indirect employment opportunities, during both construction and operation of the solar plant.

In light of the benefits of the proposal and the low level of environmental impact, the proposal is considered to be ecologically sustainable and justified.

10 REFERENCES

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